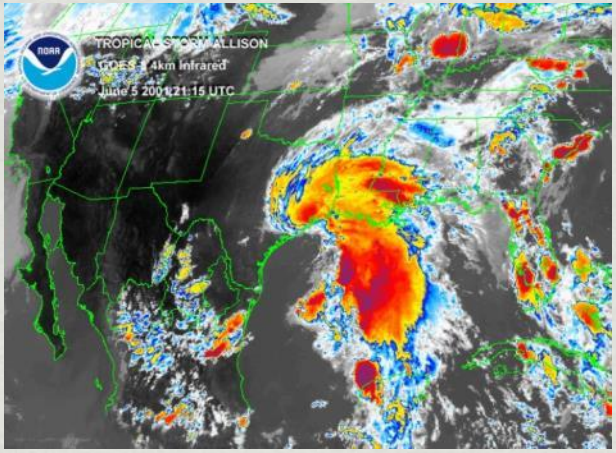
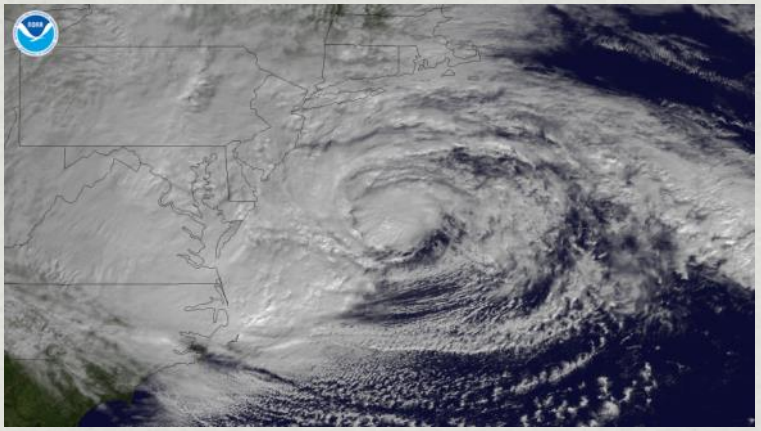
Upcoming Changes to NHC Products, Services, and Warnings

Daniel Brown
National Hurricane Center
SECART Webinar
27 May 2014

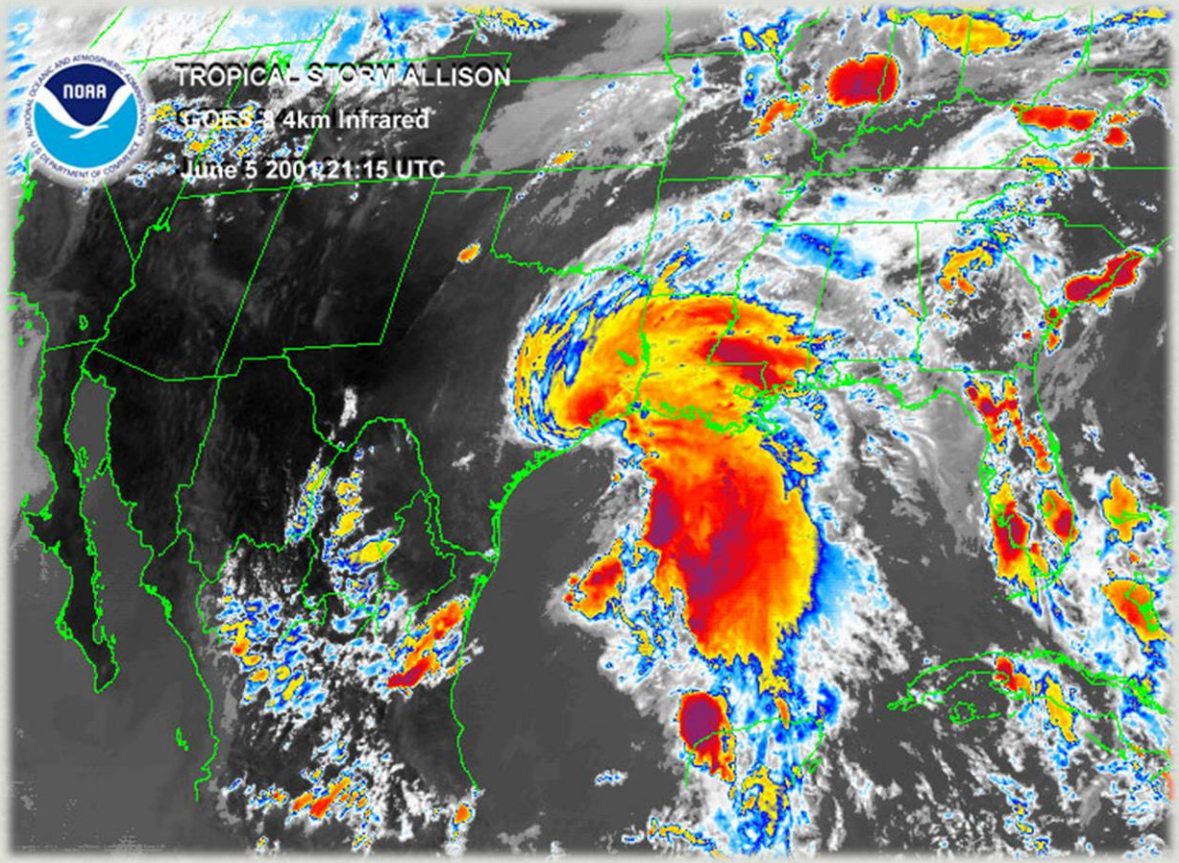
Lessons from recent tropical cyclones

Emphasize hazards, not categories



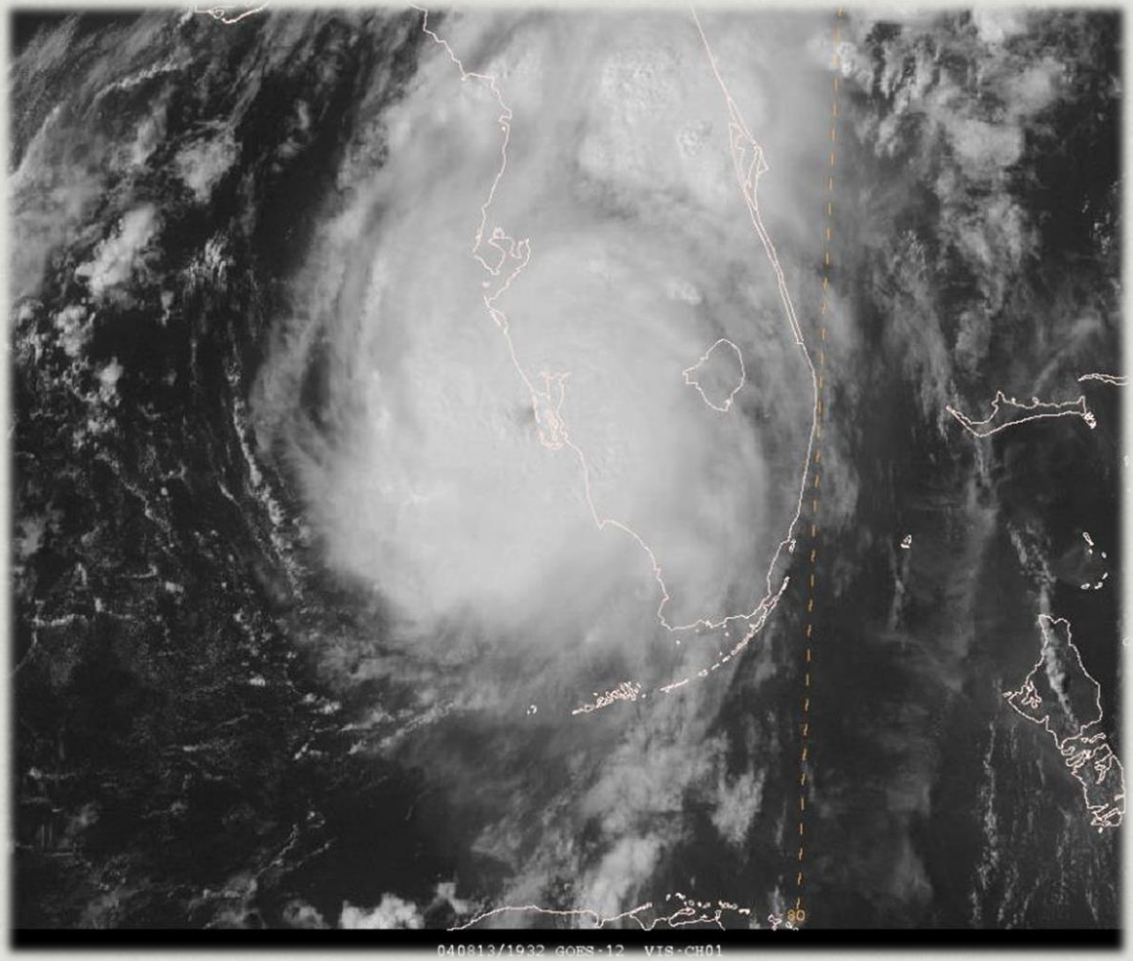


Allison 2001



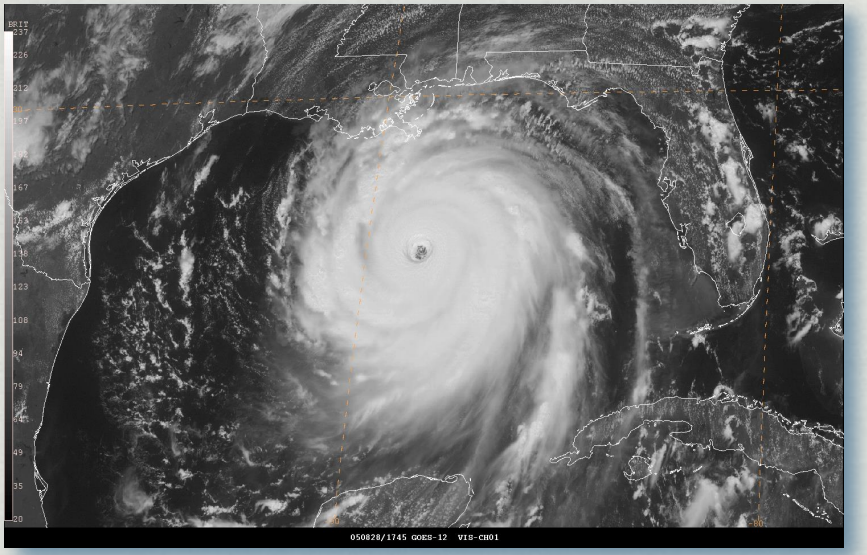
Minimal tropical storm, but slow moving = copious amounts of rain

Charley 2004

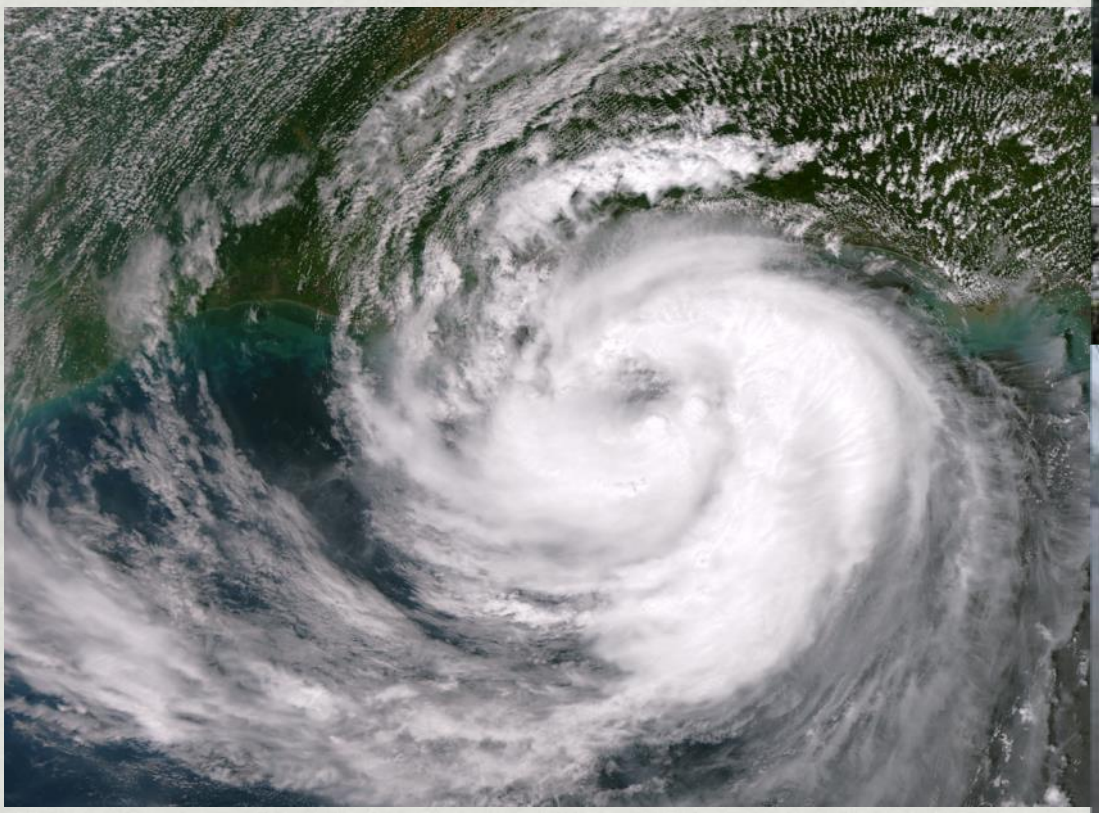


Compact category 4 hurricane =
Incredible wind damage, but little surge

Katrina 2005

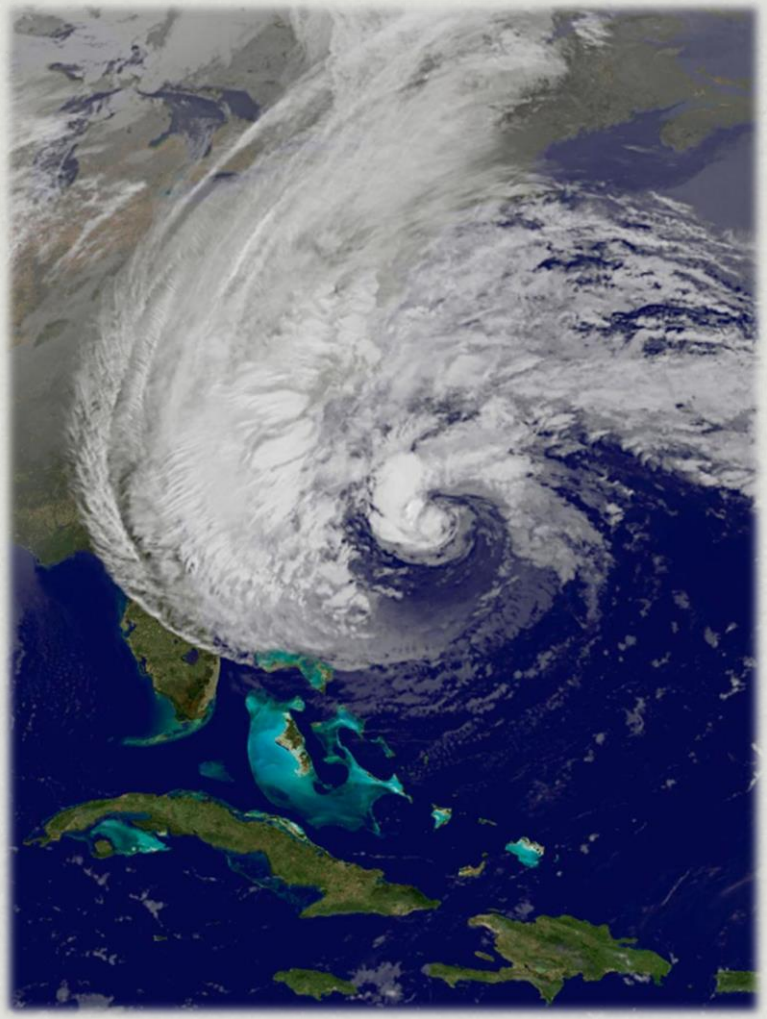


Isaac 2012



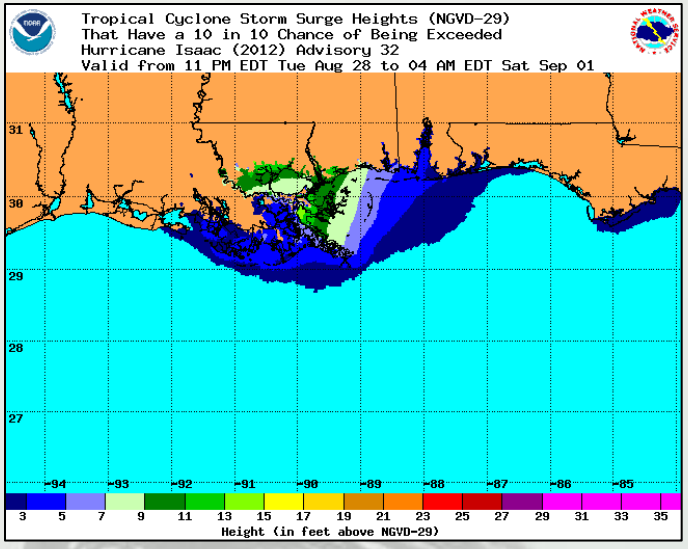
Large, slow moving category 1 hurricane =
Extensive storm surge in portions of SE Louisiana

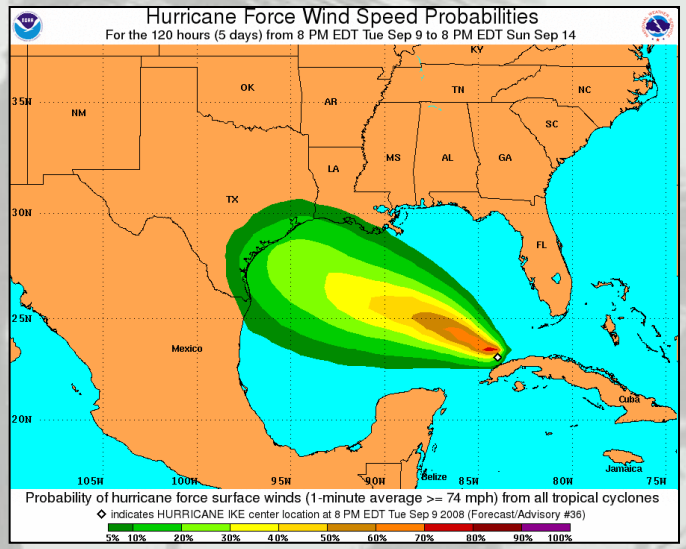
Sandy 2012



Recent NHC Product Improvements

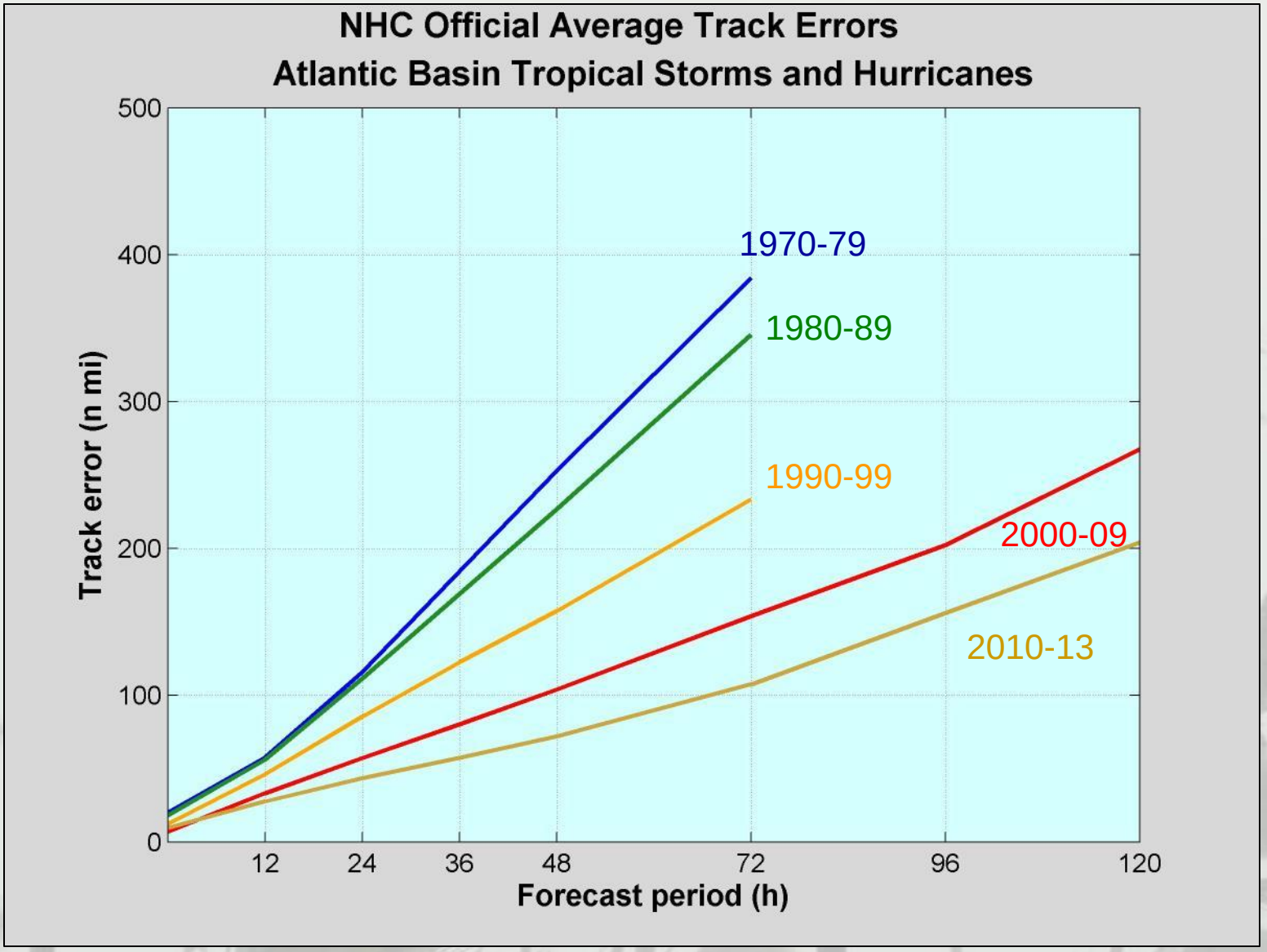
- Addition of probabilistic products
  - Wind Speed Probabilities (2005)
  - Storm Surge Probabilities (2007)
- Graphical Tropical Weather Outlook introduced in 2007, color-coded probabilities added in 2008
- Tropical Storm and Hurricane Watch and Warning lead times increased in 2010
- Time covered by the NHC Tropical Weather Outlook increased from 48 hours to 5-days in 2013





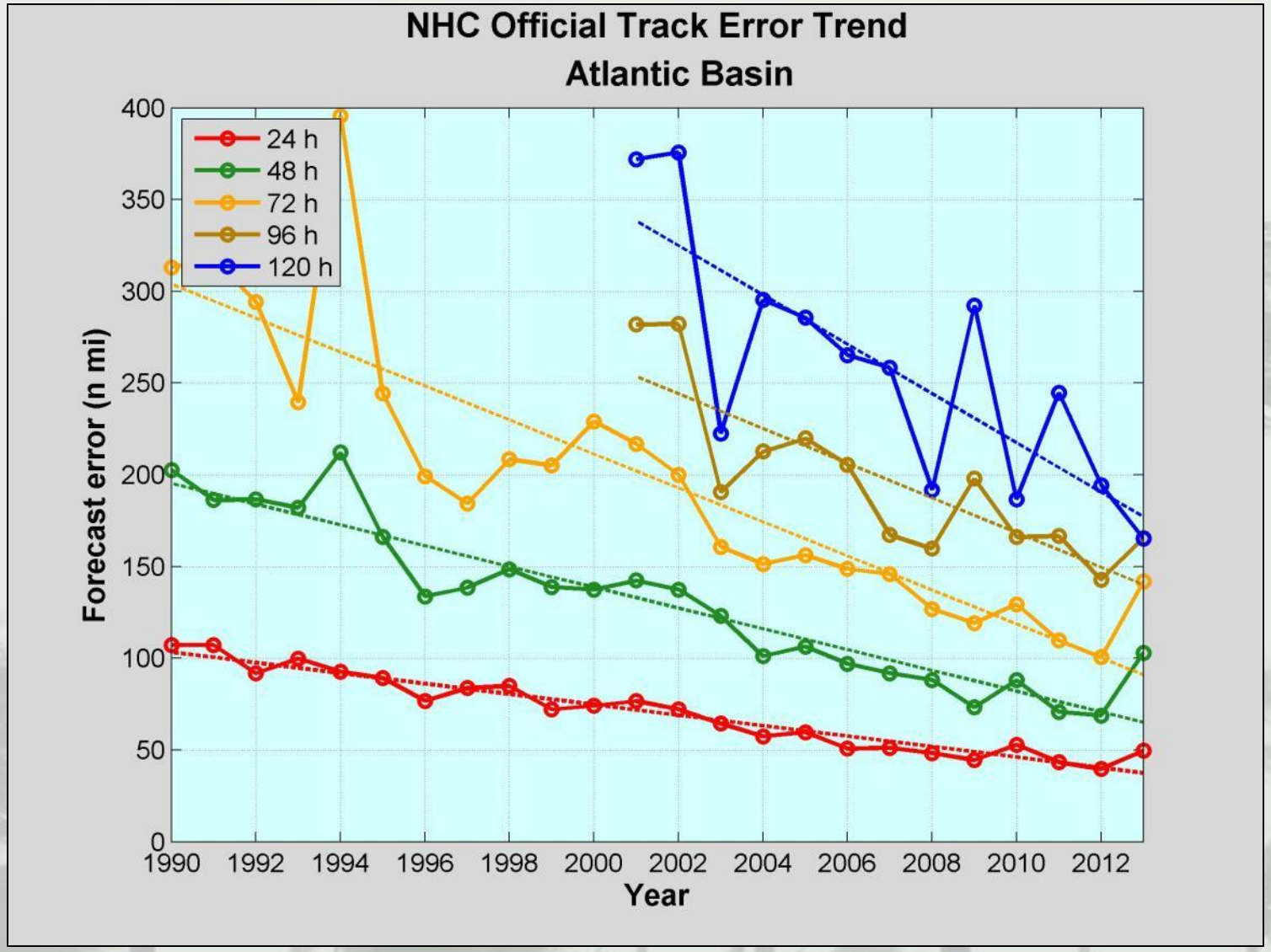
Recent Forecast Improvements

NHC Track Forecast Accuracy Improvements Continue



NHC Atlantic Track Error Trends

Significant Reduction in Track Errors Since 1990



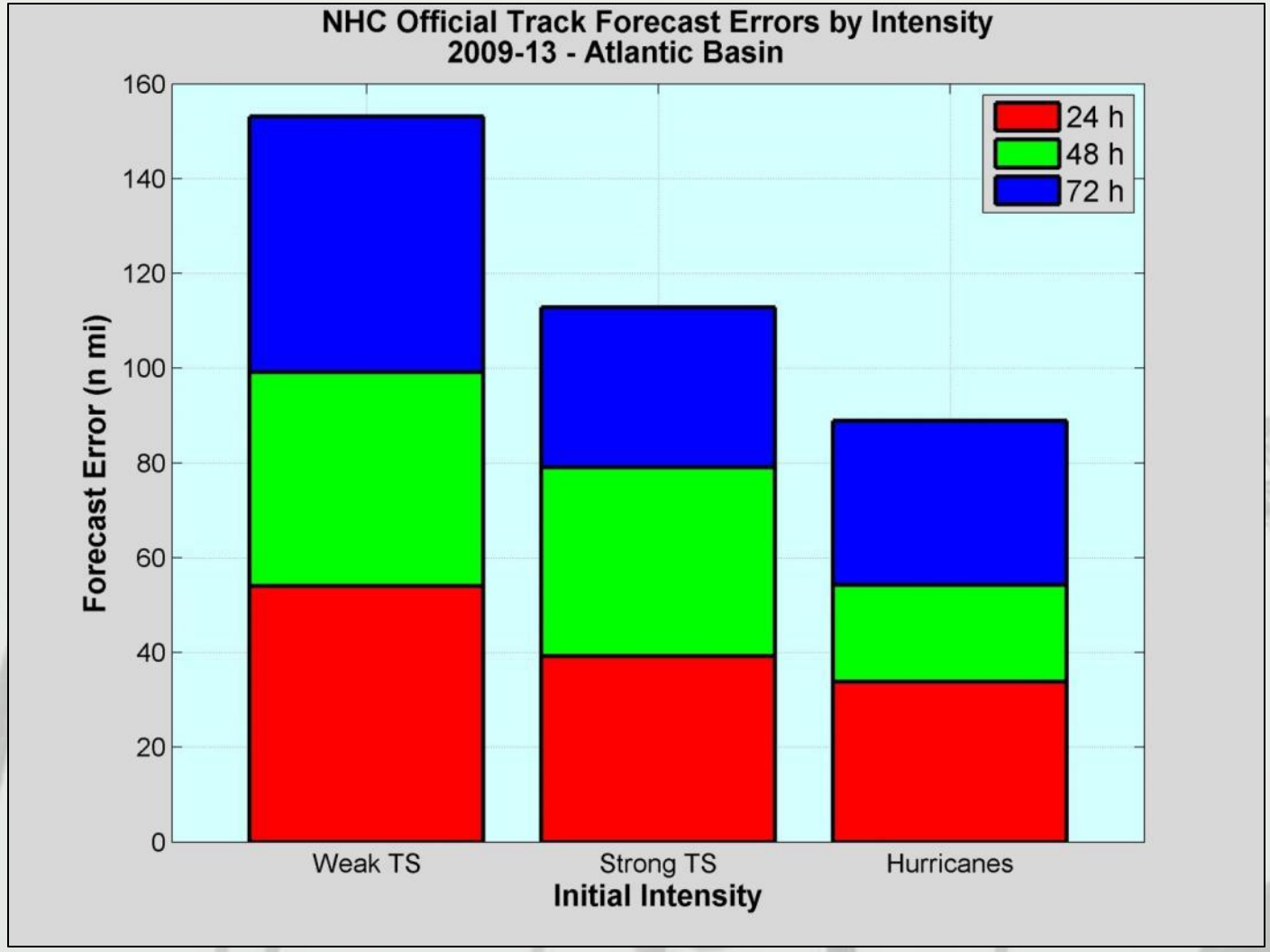
Error Reduction since 1990:

72 h: 67%

48 h: 65%

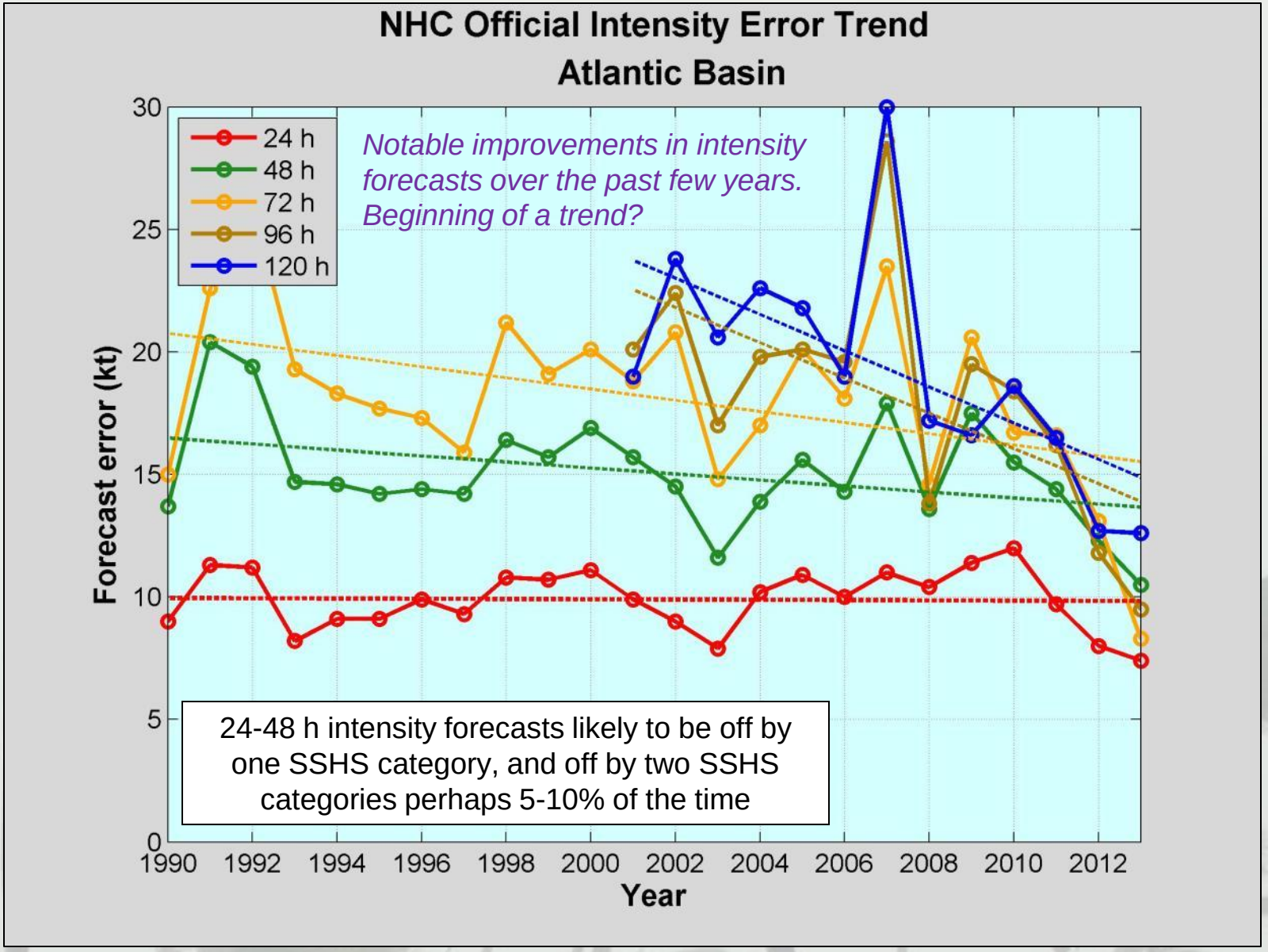
24 h: 58%

Track Errors by Initial Intensity



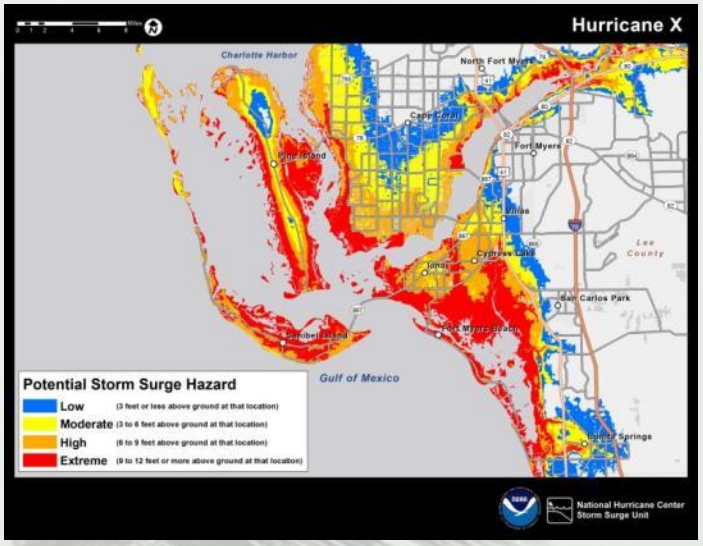
As the initial intensity of the storm increases, NHC track errors on average get smaller.

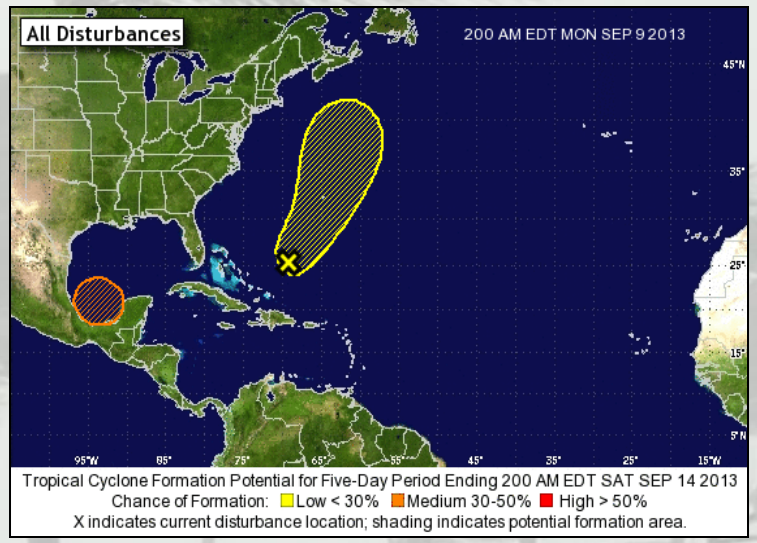
Little Progress with Intensity



2014 NHC Product Changes

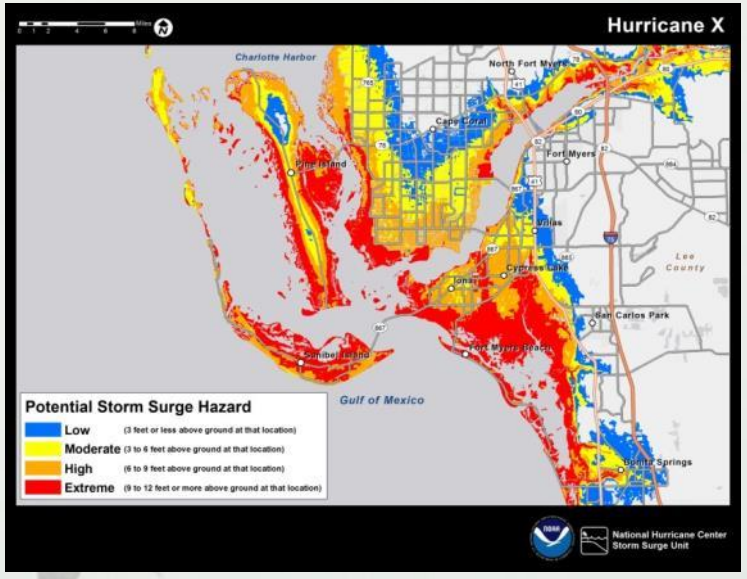
- Potential Storm Surge Flooding Map
- New 5-day Graphical Tropical Weather Outlook
- Changes to the 48-hour Graphical Tropical Weather Outlook
- Elimination of the Maximum Intensity Probability Table
- Mixed case text in the Tropical Weather Outlook and Tropical Cyclone Discussion

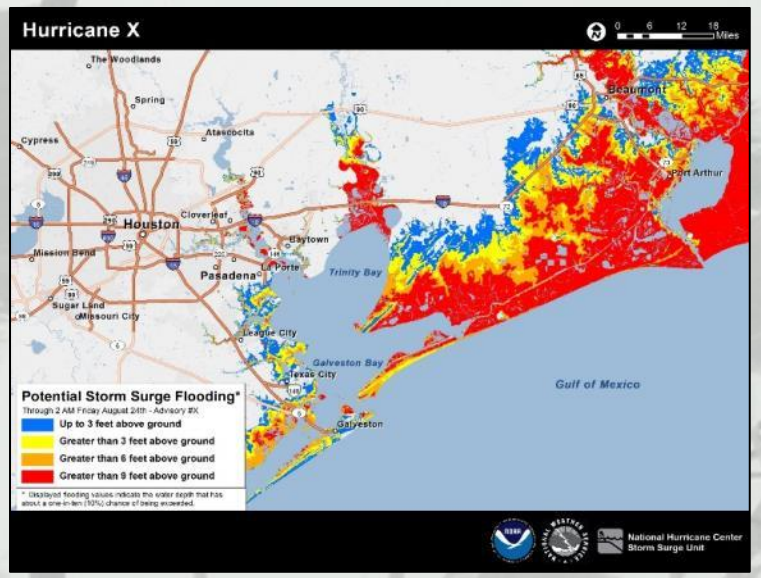




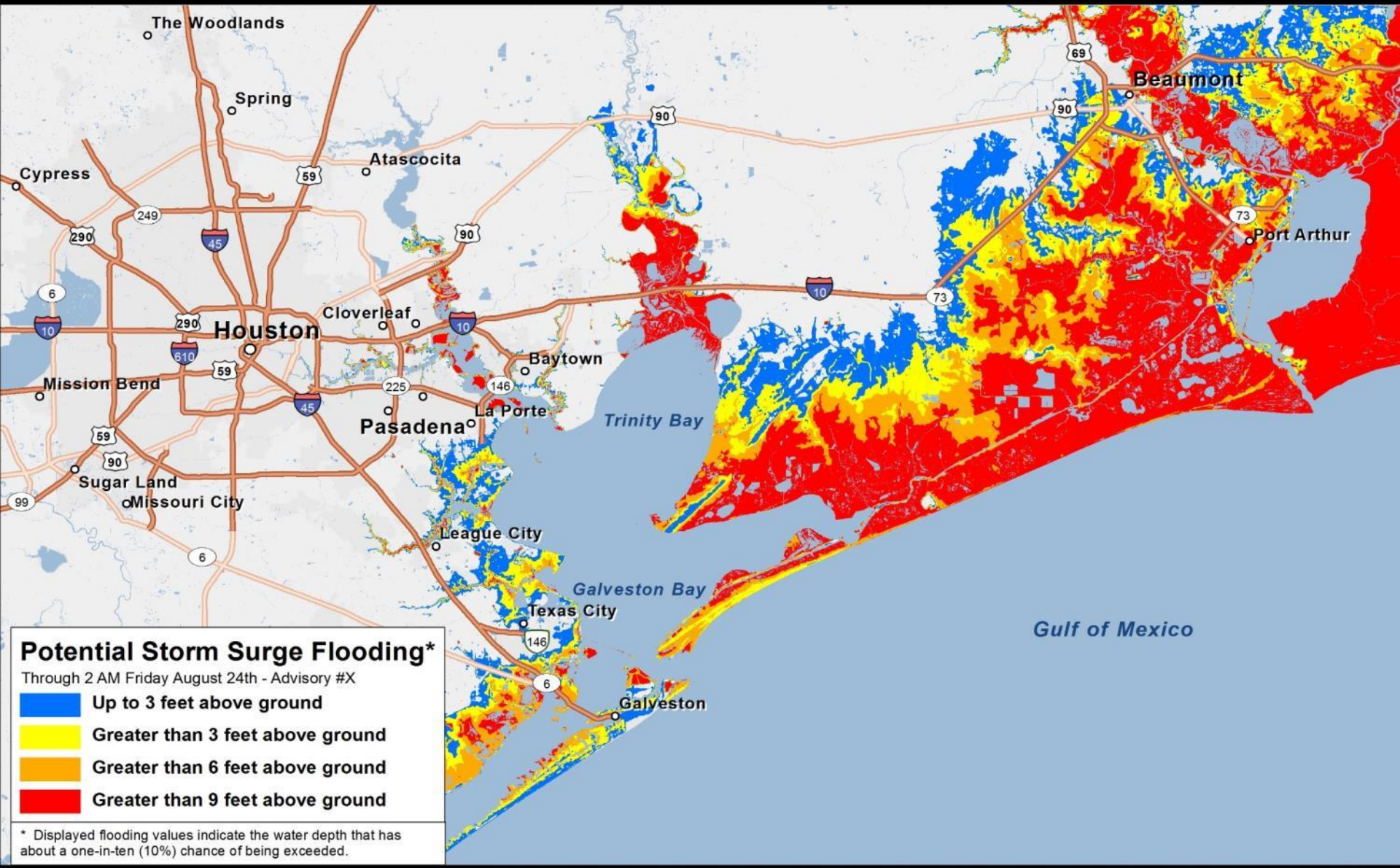
Potential Storm Surge Flooding Map

- Highlights areas where inundation from storm surge could occur and height above ground that the water could reach
- Depicts the reasonable worst-case scenario for any individual location
  - Shows inundation levels that have a 10% chance of being exceeded
- First map issued at the same time as the initial hurricane watch or in some cases, with a tropical storm watch
- Due to processing time, the map will not be available until about <u>45 to 60 minutes following</u> the advisory release



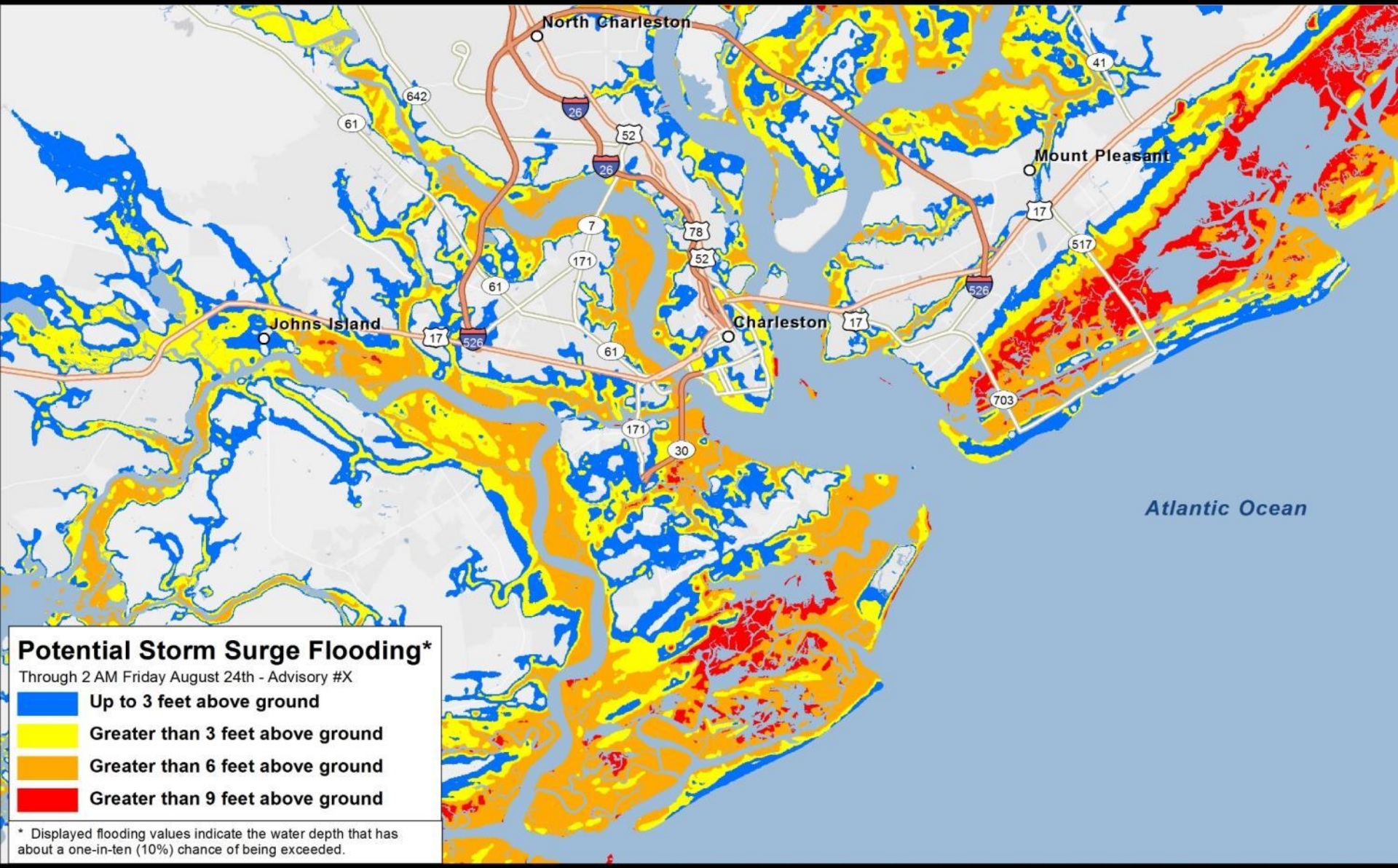


Hurricane X



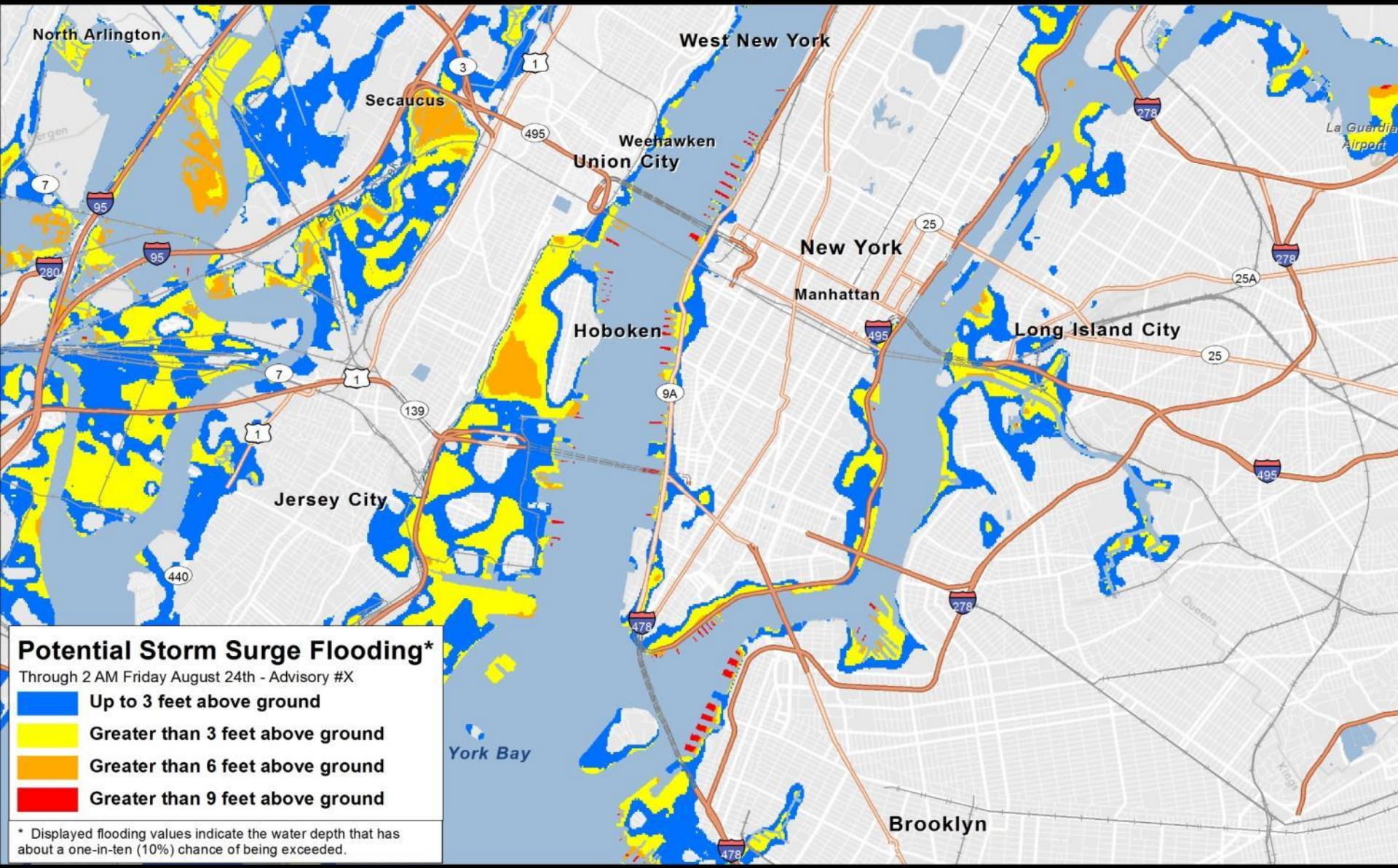
National Hurricane Center
Storm Surge Unit

Hurricane X



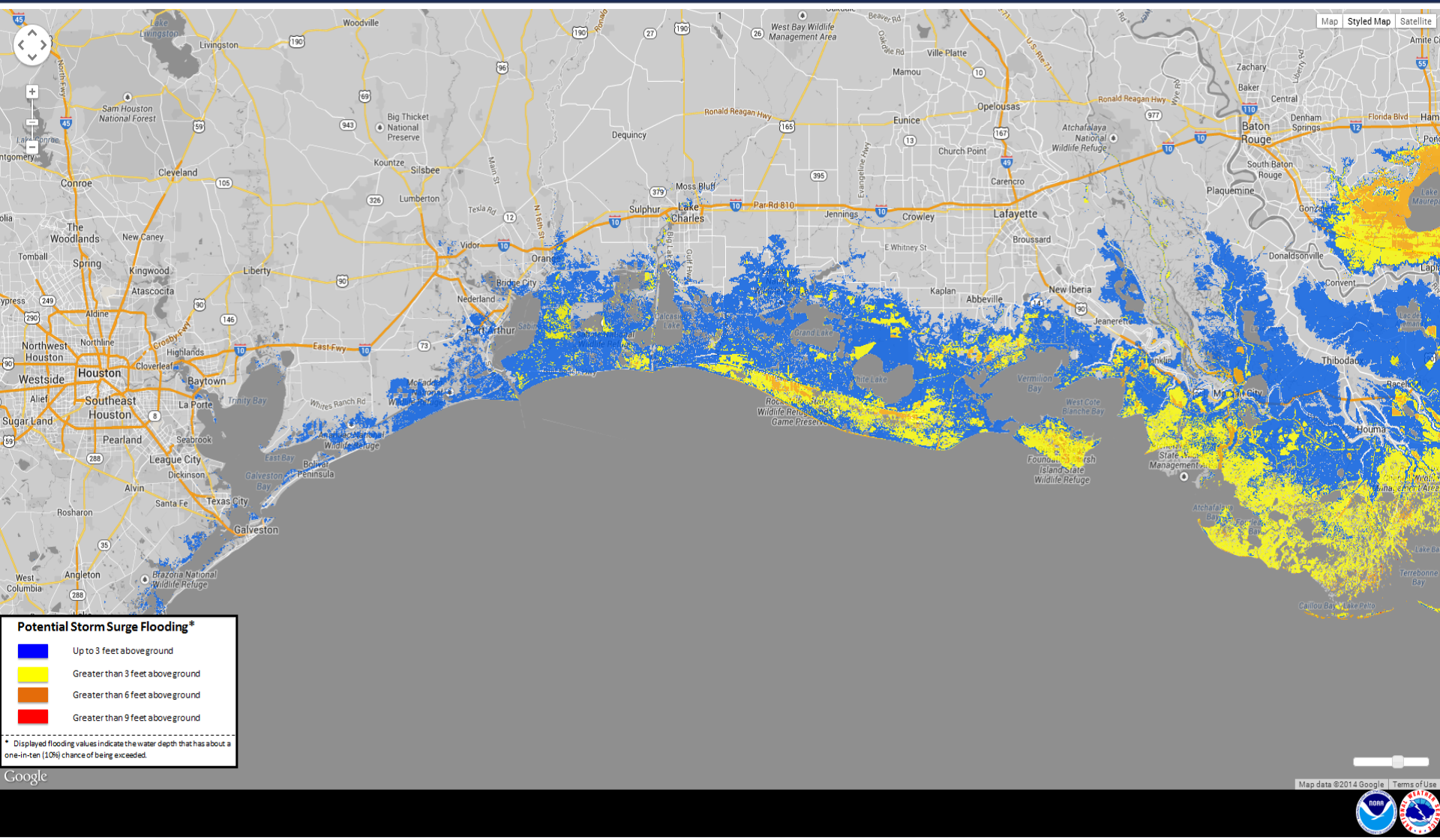
National Hurricane Center
Storm Surge Unit

Hurricane X

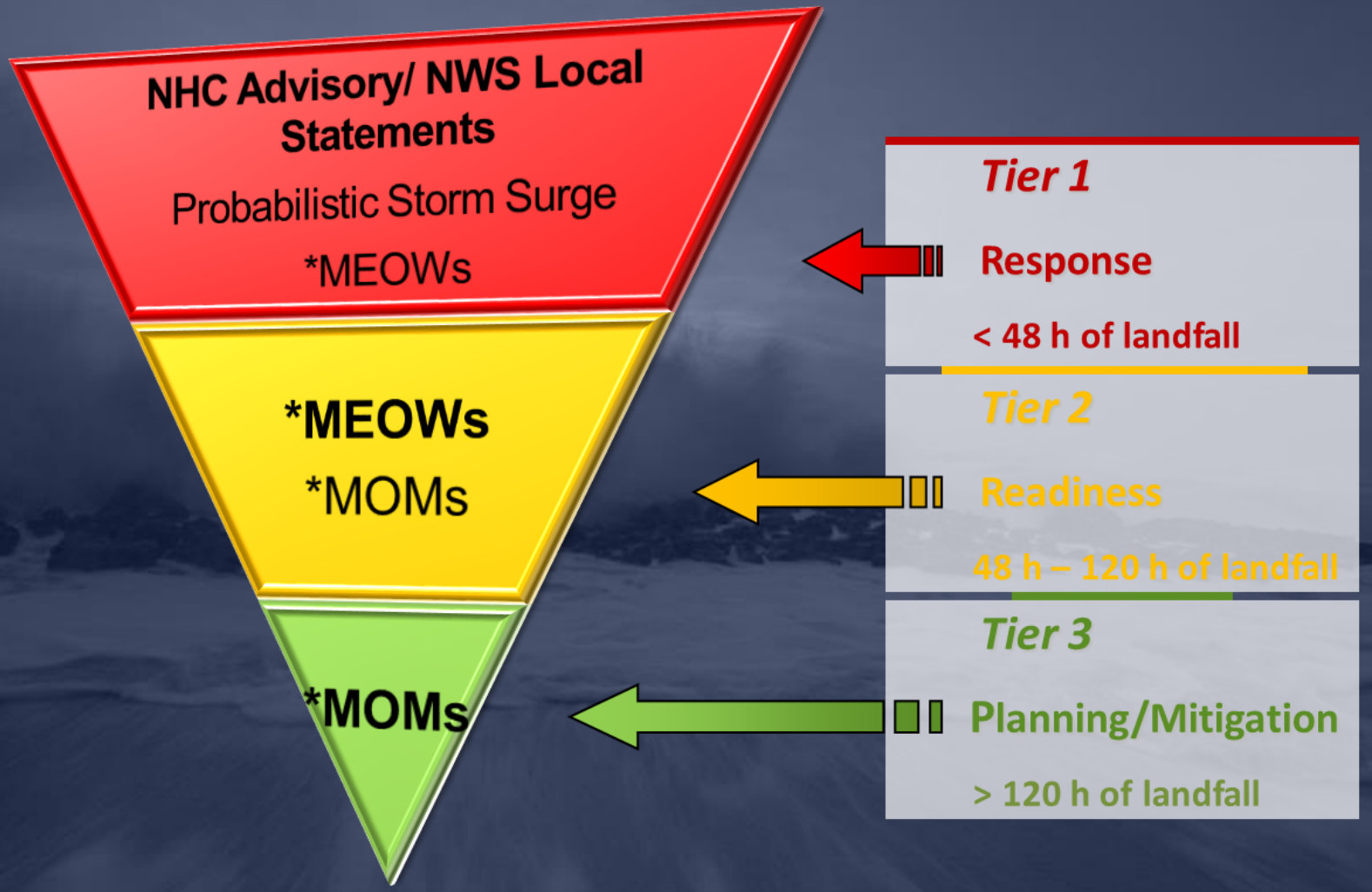


National Hurricane Center
Storm Surge Unit

Viewable in Google Map Interface



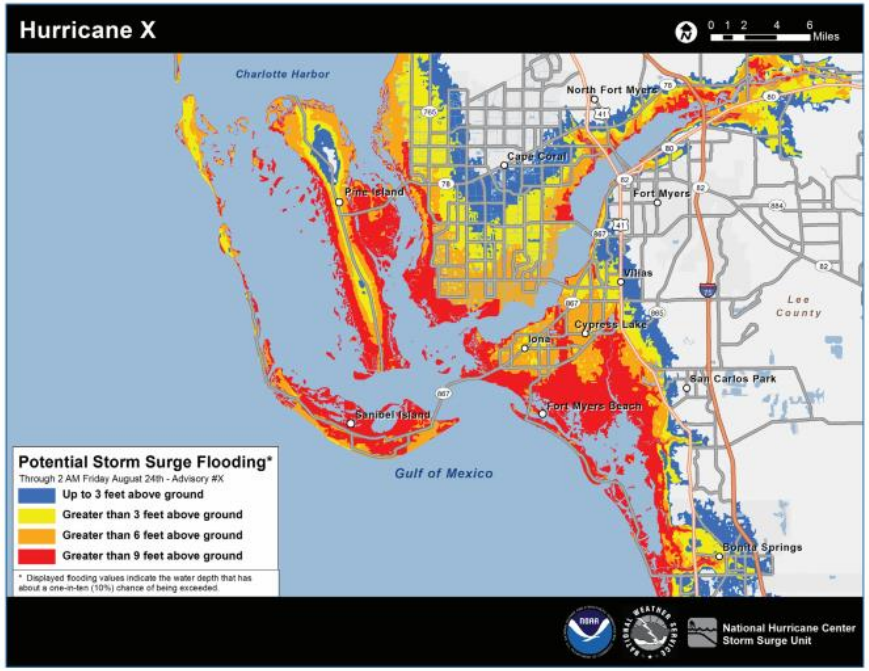
Storm Surge Decision Support Wedge



New Storm Surge Fact Sheets are Available for Outreach

When a storm is threatening your area, always follow the instructions of local officials

1. Storm surge is often the greatest threat to life and property from a hurricane. It poses a significant threat for drowning. A mere **six inches** of fast-moving flood water can knock over an adult. It takes only **two feet** of rushing water to carry away most vehicles—including pickups and SUVs.
2. Storm surge can cause water levels to rise quickly and flood large areas—sometimes in just minutes, and you could be left with no time to take action if you haven't already evacuated as instructed.
3. Storm surge values do not correspond well to the hurricane wind categories (of the Saffir-Simpson Hurricane Wind Scale) that range from 1 to 5. These categories are based only on winds and do **not** account for storm surge.
4. Tropical storms, category 1 or 2 hurricanes, major (category 3 to 5) hurricanes, and post-tropical cyclones can **all** cause life-threatening storm surge.
5. Storm surge can also occur with non-tropical storms like Nor'easters and other winter storms.
6. Many U.S. Gulf and East Coast areas are vulnerable to storm surge, including areas up to several miles inland from the coastline. **Find out today, well before a hurricane ever approaches, if you live in a storm surge evacuation zone.**
7. Storm surge can occur before, during, or after the center of a storm passes through an area. Storm surge can sometimes cut off evacuation routes, so do not delay leaving if an evacuation is ordered for your area.



If a tropical storm or hurricane is threatening your community, go to www.nhc.noaa.gov to see a map like this, which will show potential storm surge flooding for your area

8. During the peak of a storm surge event, it is unlikely that emergency responders will be able to reach you if you are in danger.
9. Even if your community is not directly affected by storm surge, it could experience other hazards from the storm and face dangerous conditions such as **impassable roads, water and sewage problems, and power outages.** If power remains on, downed electrical wires can pose an **electrocution risk.**
10. Weather conditions and the forecast can change. Local officials could issue evacuation or other instructions for many reasons. **Always follow the instructions of local officials.**

Two public fact sheets are available, also one for emergency managers and for media professionals. Available at: www.nhc.noaa.gov/surge/resources.php

Tropical Weather Outlook Enhancements

TROPICAL WEATHER OUTLOOK
NWS NATIONAL HURRICANE CENTER MIAMI FL
800 PM EDT WED SEP 1 2014

For the North Atlantic, Caribbean Sea, and the Gulf of Mexico…

A broad area of low pressure located a couple of hundred miles south-southwest of Jamaica is accompanied by showers and thunderstorms. This disturbance remains disorganized…and development, if any, should be slow to occur over the next couple of days while it moves slowly northwestward. Environmental conditions are expected to be marginally conducive for some development when the system moves over the northwestern Caribbean Sea and the southern Gulf of Mexico later this week. Locally heavy rainfall is possible over portions of Haiti and Jamaica today, and will likely spread across the Cayman Island and eastern Cuba on Tuesday.

* Formation chance through 48 hours…low…10 percent
* Formation chance through 5 days…medium…30 percent

A limited amount of disorganized cloudiness and showers are occurring in association with a broad area of low pressure centered about 600 miles east of the Leeward Islands. This low is expected to continue moving slowly westward, but environmental conditions appear hostile for development.

* Formation chance through 48 hours…low…10 percent
* Formation chance through 5 days…low…10 percent

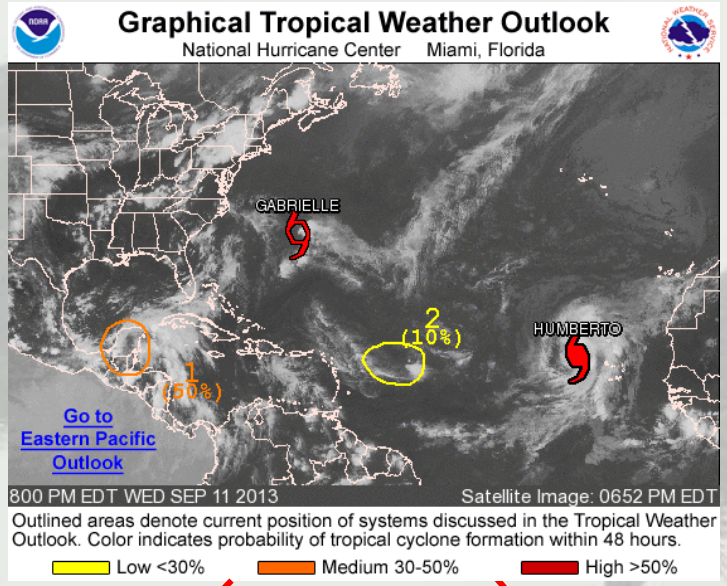
Forecaster Brown

- Text to be in mixed-case
- Provides both 48 hour and 5 day probabilities of formation
- Probabilities will be in a tabular format below the paragraph describing each disturbance

Issuance times remain 2 AM, 8 AM, 2 PM, and 8 PM EDT. One hour earlier during EST.

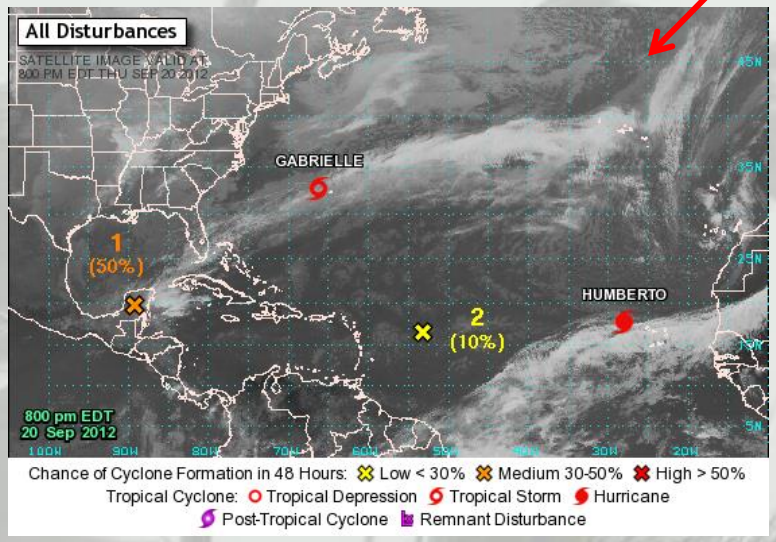
Graphical Tropical Weather Outlook: New Look Starting July 2014

Previous Graphical Outlook

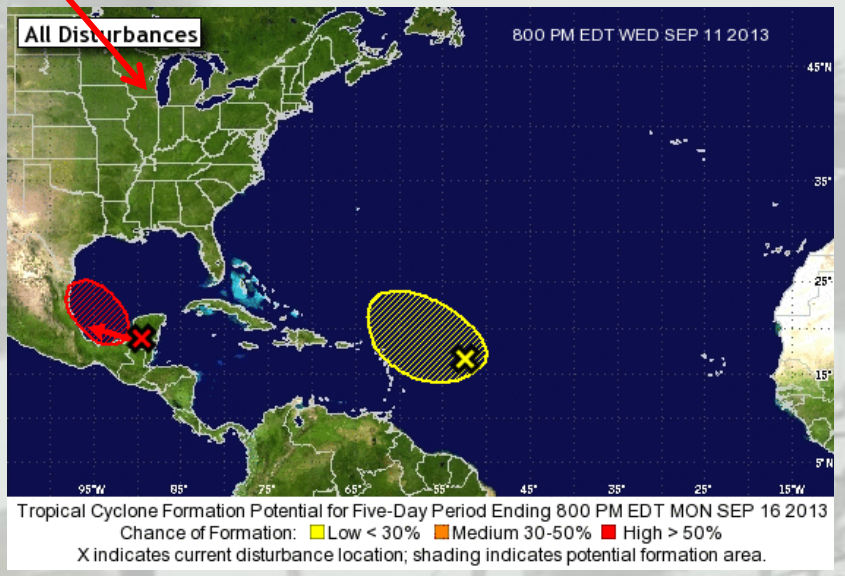


Corresponding text provided as mouse-over on web

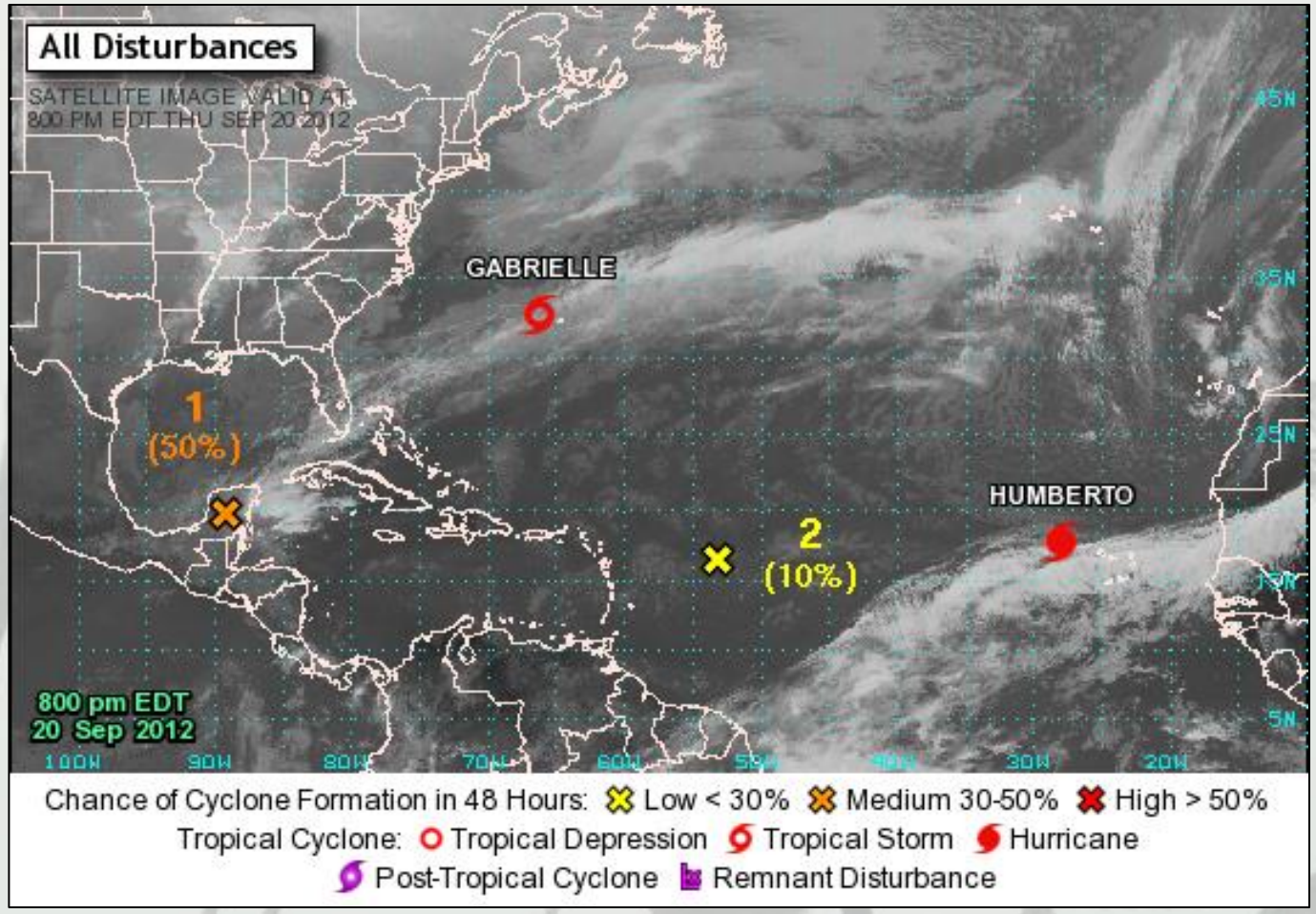
Prototype of New 48 hour GTWO



New 5-day GTWO

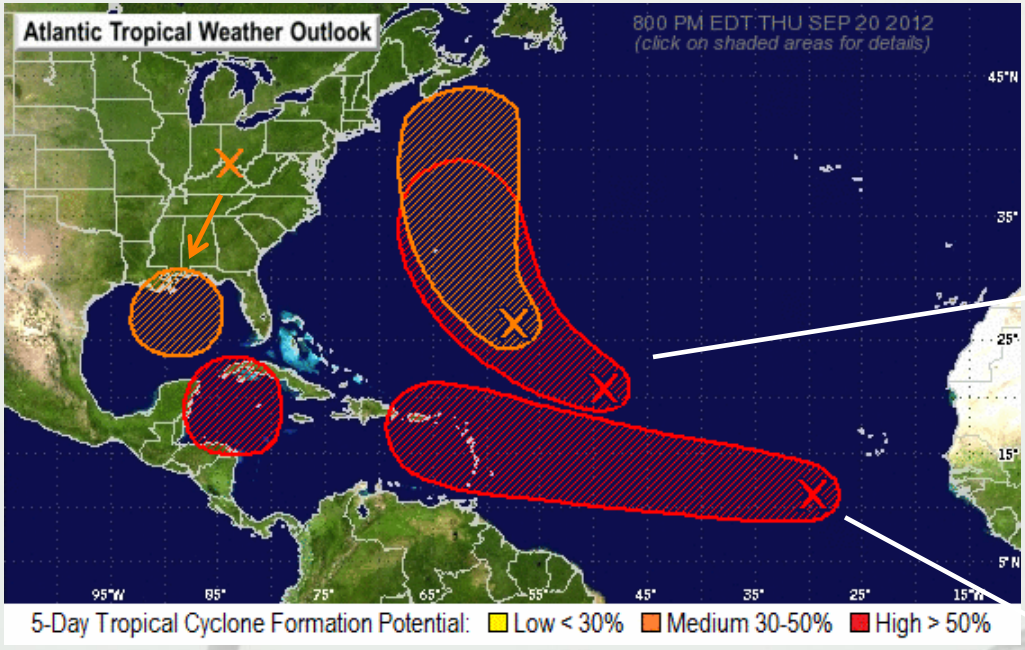


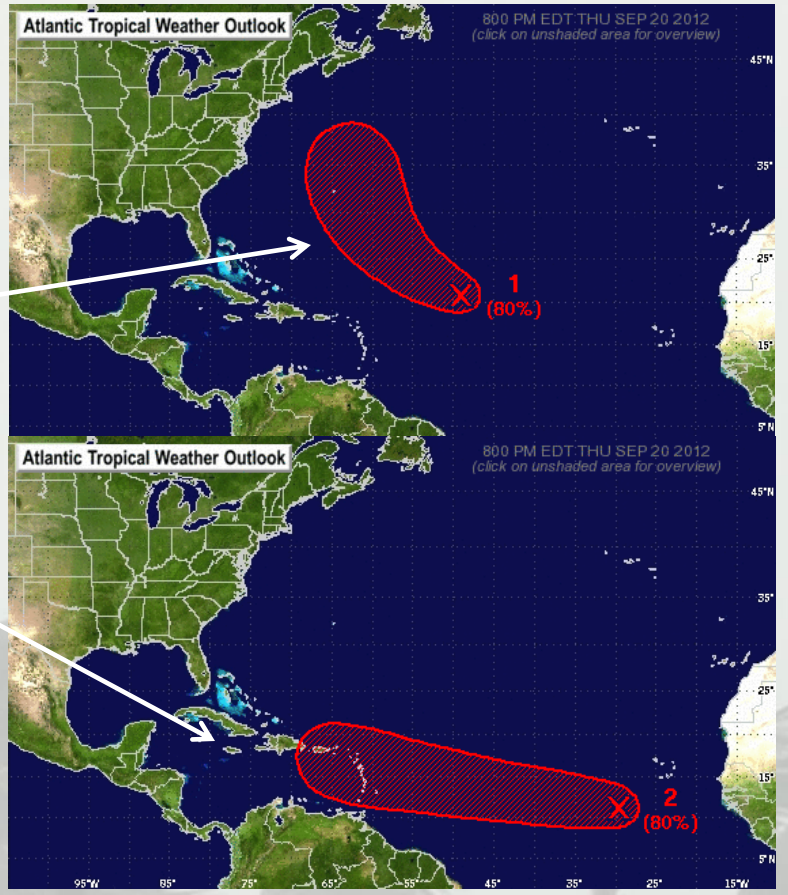
48-hour Graphical Tropical Weather Outlook



48-h Graphic no longer uses hatched areas to denoted location of disturbances. This is to avoid confusion over the meaning of hatched areas between the 2- and 5-day graphics.

5-day Graphical Tropical Weather Outlook- Beginning July 2014





- Overview graphic shows entire basin, with single disturbance graphics to aid in display when overlapping areas
- Indicates formation potential during next 5 days
- Initial location of disturbance (X) indicated, if existing at issuance time
- Shading represents potential formation area
- Location of current storms are <u>not</u> shown

Mixed-Case Text
Tropical Cyclone Discussion

- Tropical Cyclone Discussion and Tropical Weather Outlook expected to be in mixed-case text beginning in 2014

- No formatting changes are planned to the other NHC tropical cyclone advisory products at this time

Tropical Storm Sandy Discussion Number 2
NWS National Hurricane Center Miami FL AL182012
500 PM EDT Mon Oct 22 2012

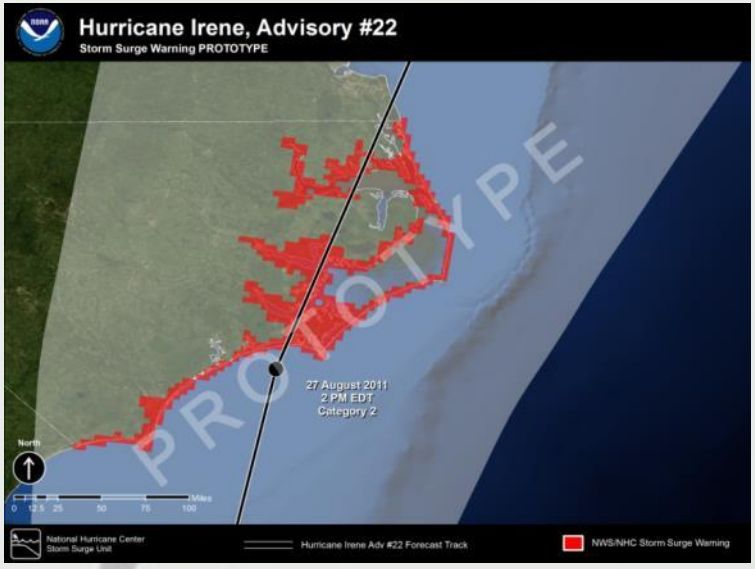
The Air Force Hurricane Hunters found a band of surface winds near 35 kt over the southeastern quadrant of the cyclone, so the system is being named at this time. The environment should be characterized by weak shear, and the storm will be over warm waters for the next couple of days so additional strengthening is likely. The official intensity forecast is similar to the previous forecast and close to the model consensus. This could be conservative, however, as the Rapid Intensification Index shows a significant possibility of rapid strengthening during the next day or so.

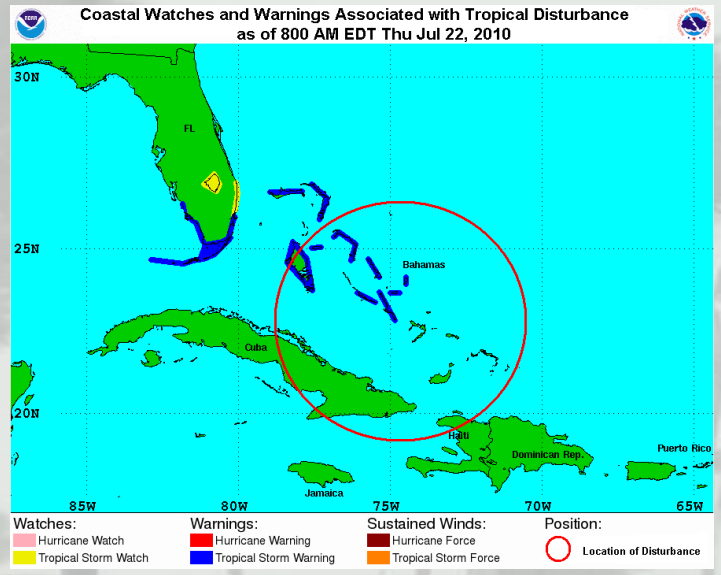
Aircraft observations show that the central region of the storm is characterized by a fairly flat pressure field, but the center appears to be located somewhat to the south of the previous estimates. However, little overall motion appears to have taken place this afternoon. Global models predict that the mid-tropospheric ridge to the north of Sandy will gradually weaken within the next day or so, which should also the tropical cyclone to begin moving north to northeastward soon. The official track forecast is somewhat to the west of the model consensus but not as far west as the latest ECMWF forecast. This is only a little to the west of the previous official forecast track.

(cont.)

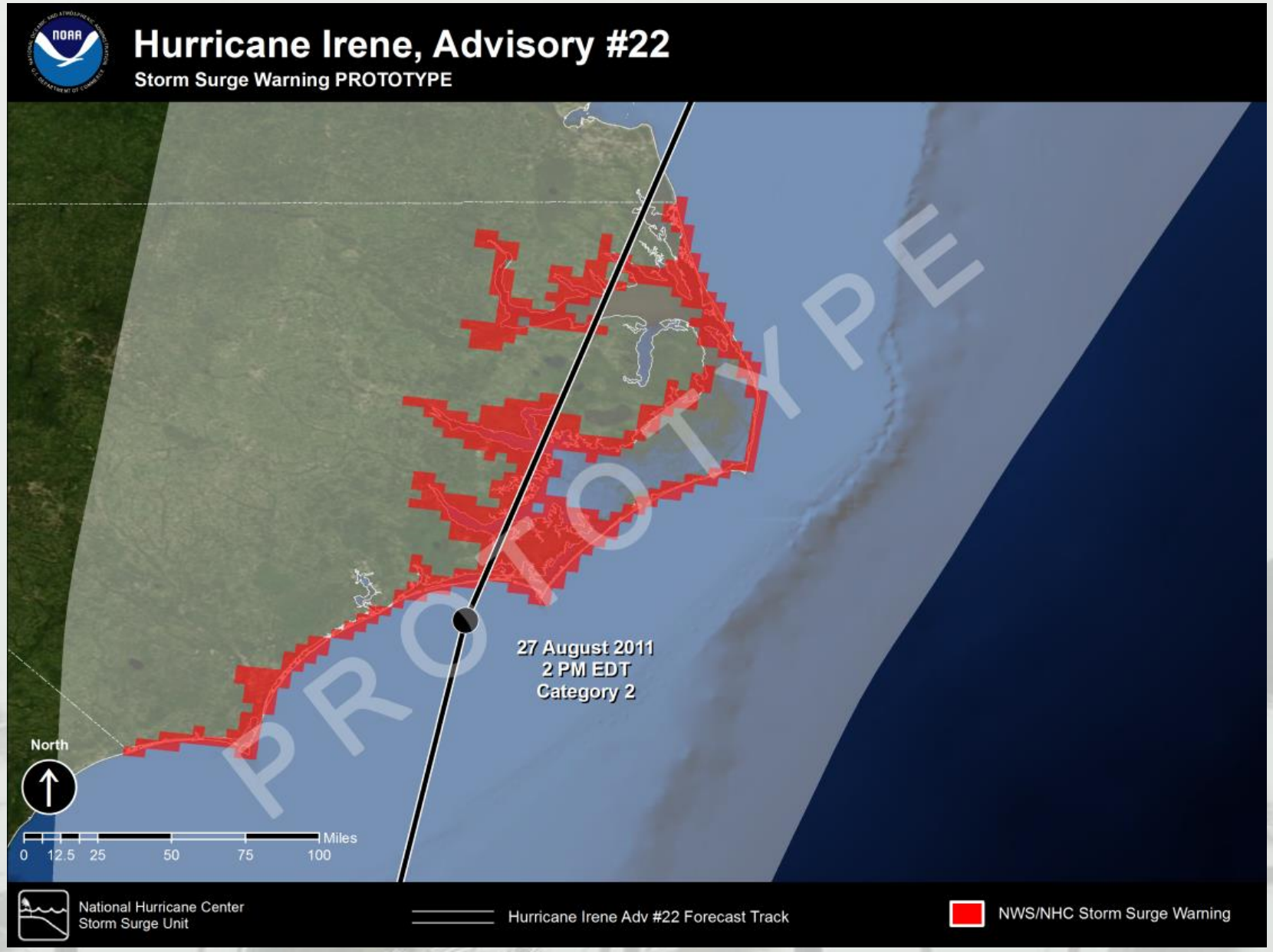
Potential Future NHC Product Enhancements

- Storm Surge Warning (2015)
- Extension of tropical cyclone forecasts to 7 days
- Tropical Storm and/or Hurricane Watches and Warnings before tropical cyclone formation



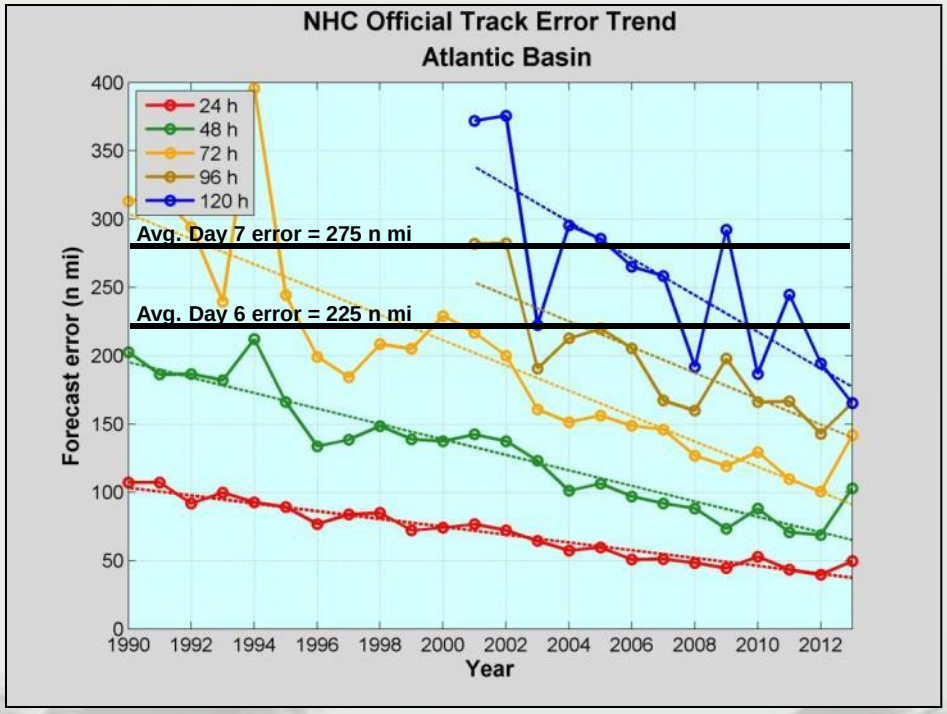


Prototype of Storm Surge Warning



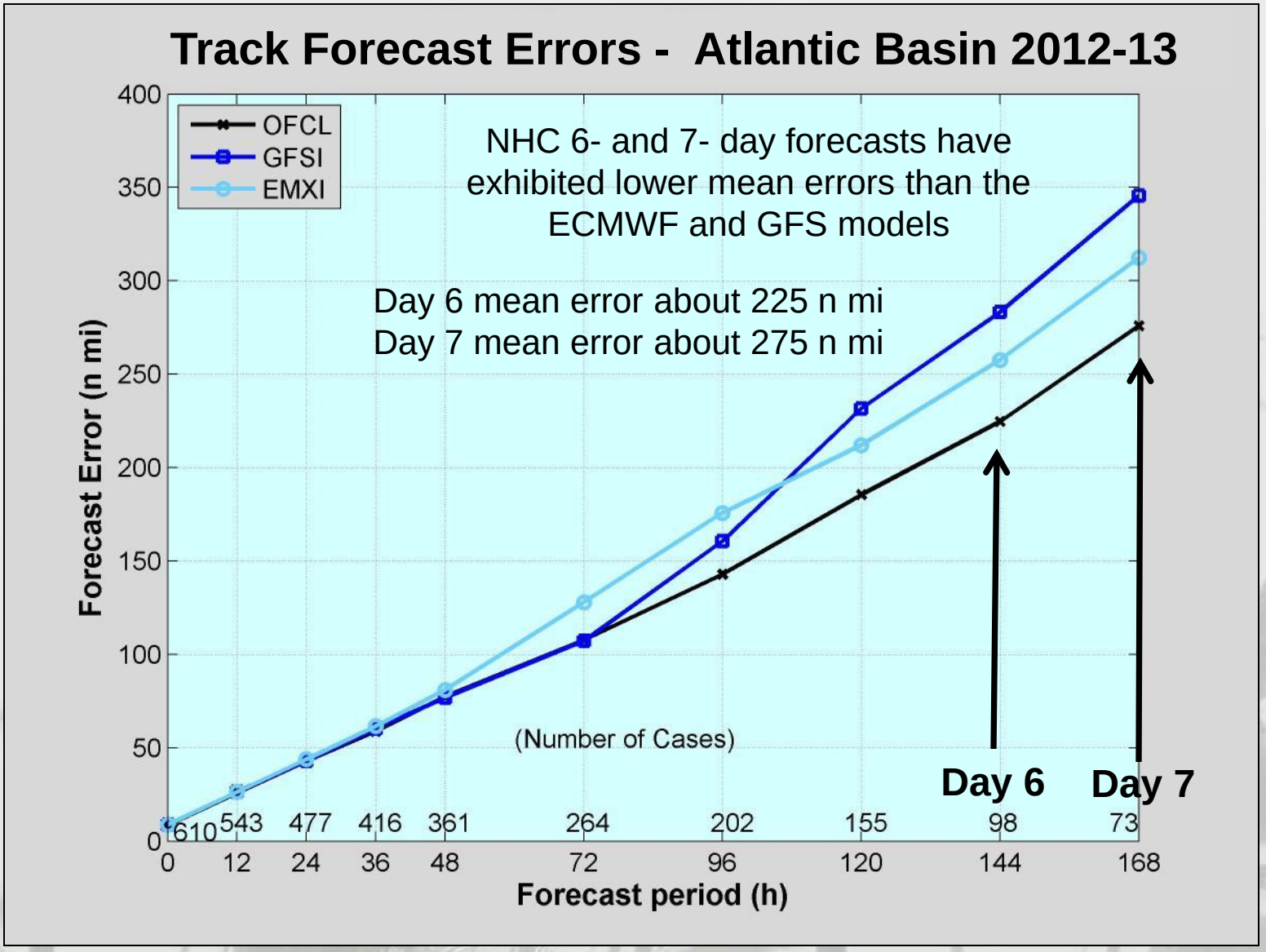
Six and Seven Day Forecasts

- NHC began producing in-house 6 and 7 day forecasts in 2012
- In-house experiment expected to continue in 2014
- Likely need a couple more seasons to fully evaluate the accuracy of the forecasts



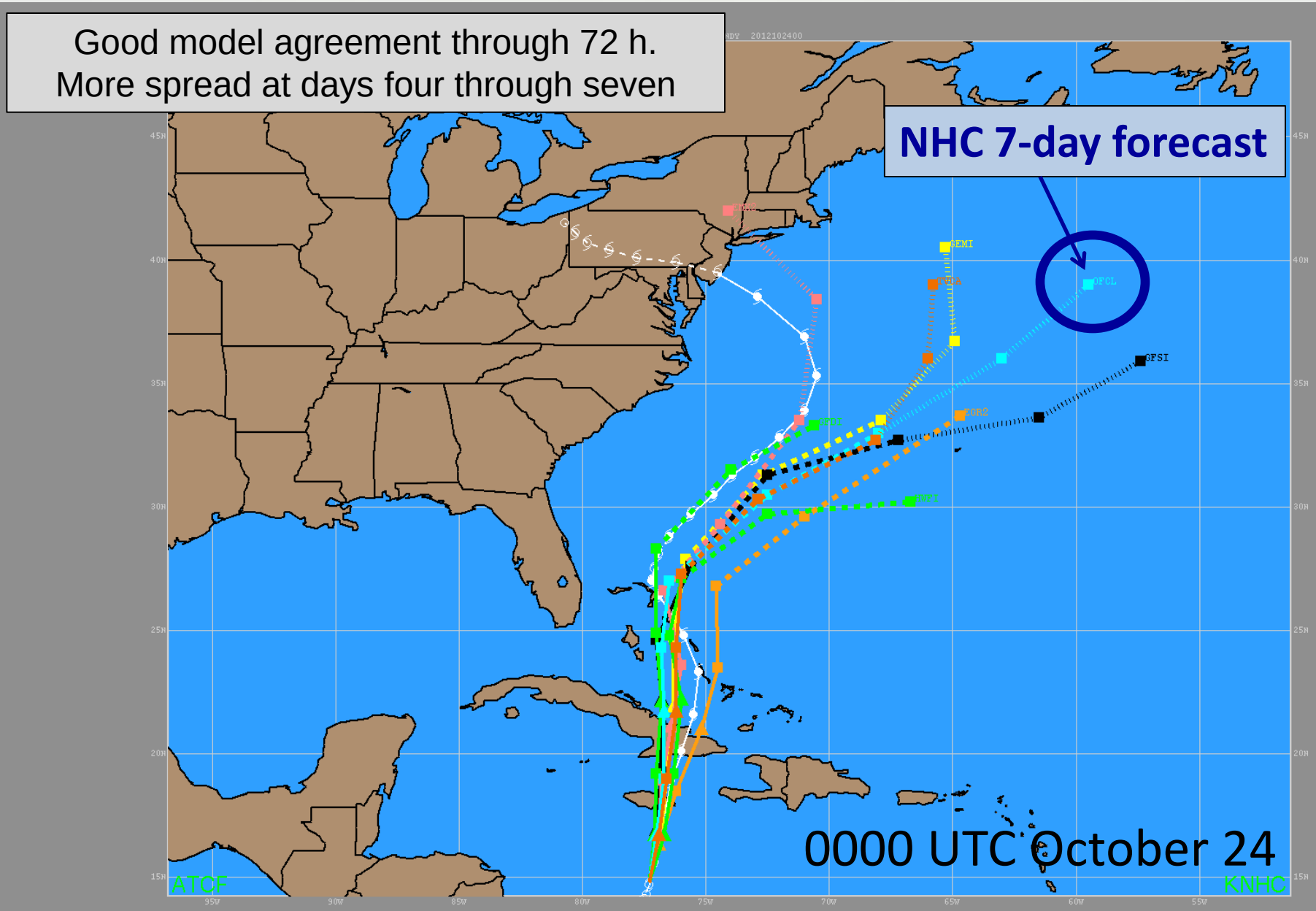
2012-13 preliminary results indicate the 6- and 7-day forecasts are about as good as the NHC 4- and 5-day forecasters were a decade ago when they were publically introduced.

Preliminary Verification
NHC 6- and 7-day Track Forecasts



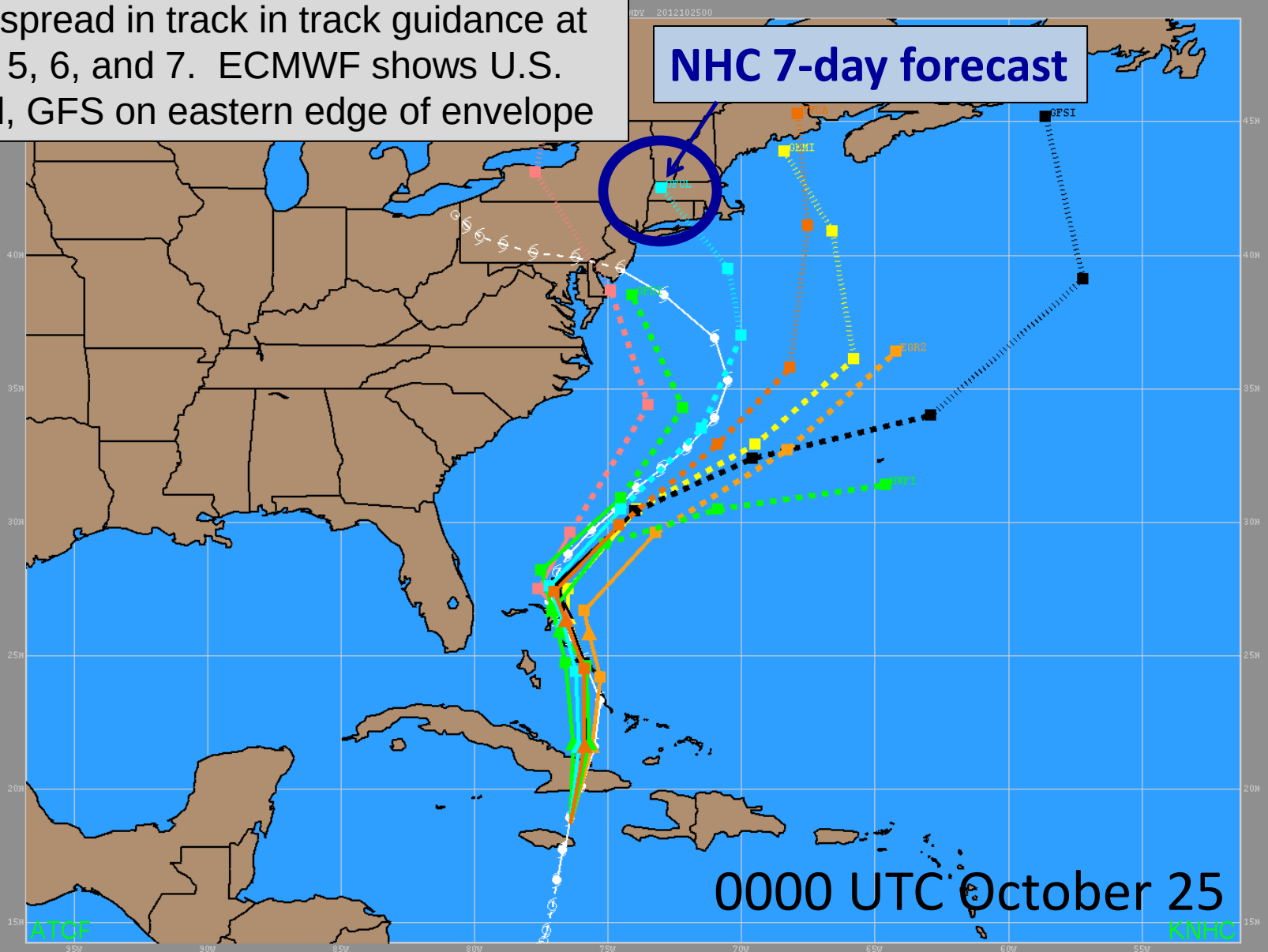
Sandy Track Guidance

Good model agreement through 72 h.
More spread at days four through seven



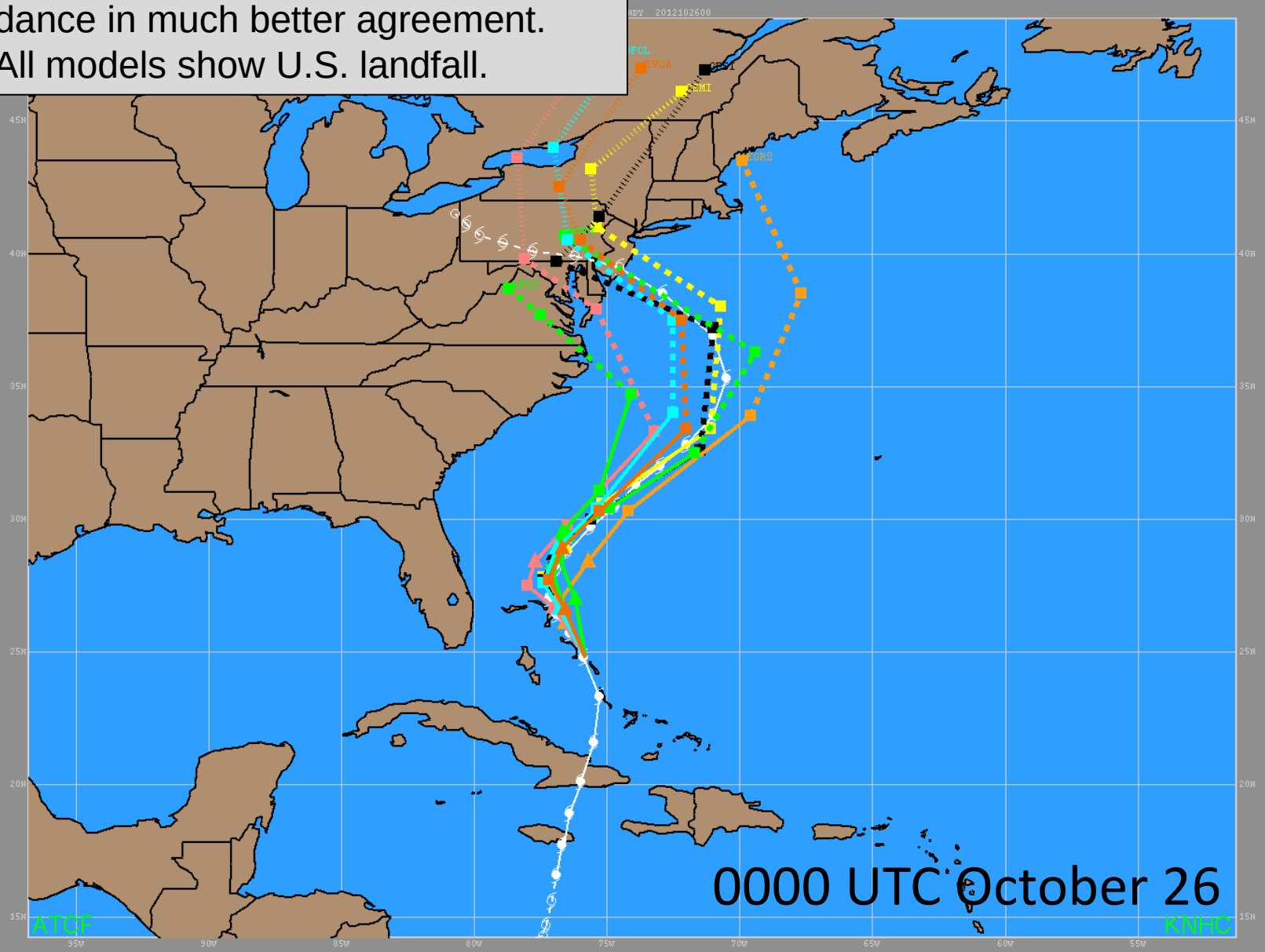
Sandy Track Guidance

Large spread in track in track guidance at days 5, 6, and 7. ECMWF shows U.S. landfall, GFS on eastern edge of envelope



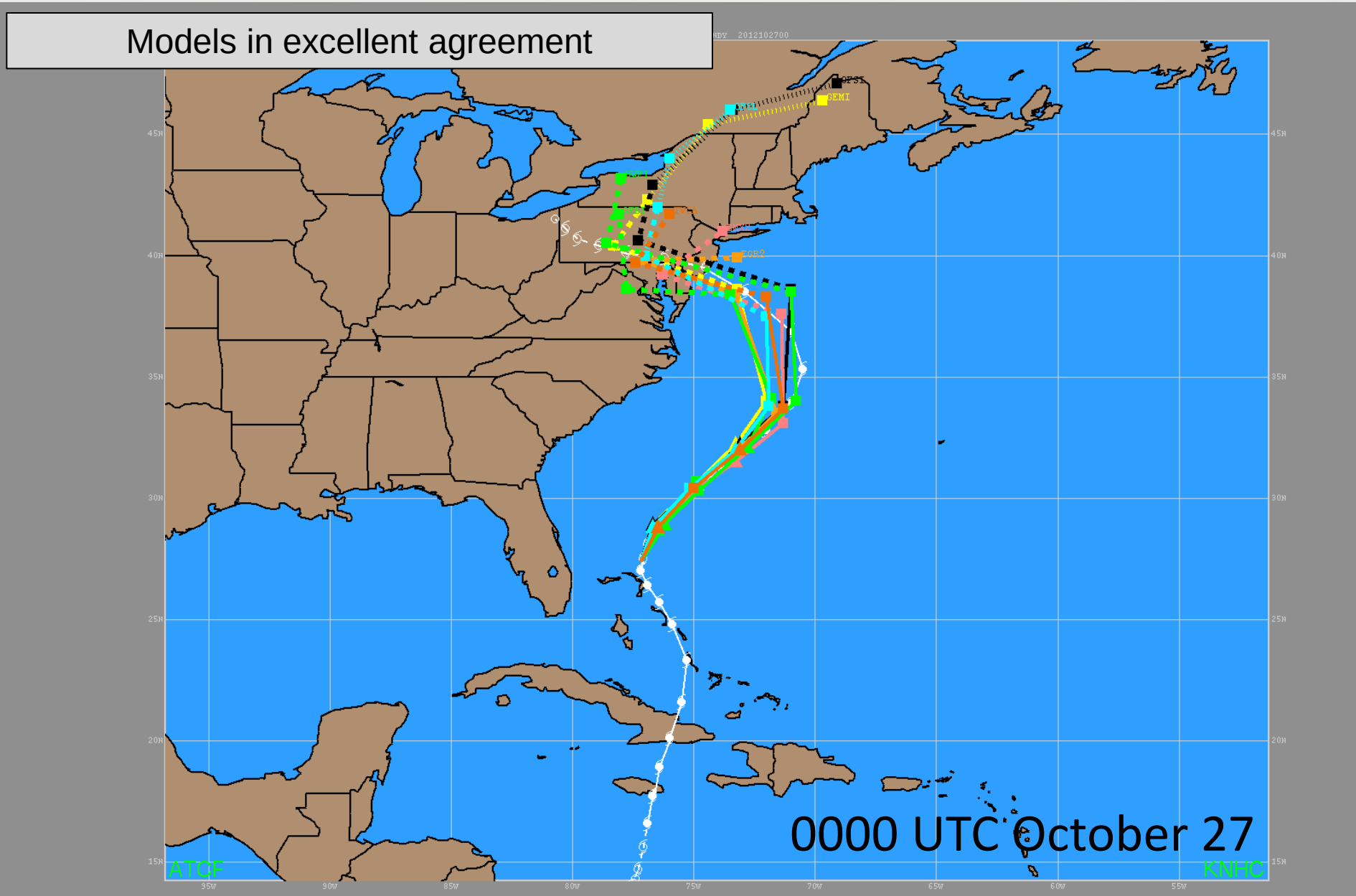
Sandy Track Guidance

Guidance in much better agreement.
All models show U.S. landfall.



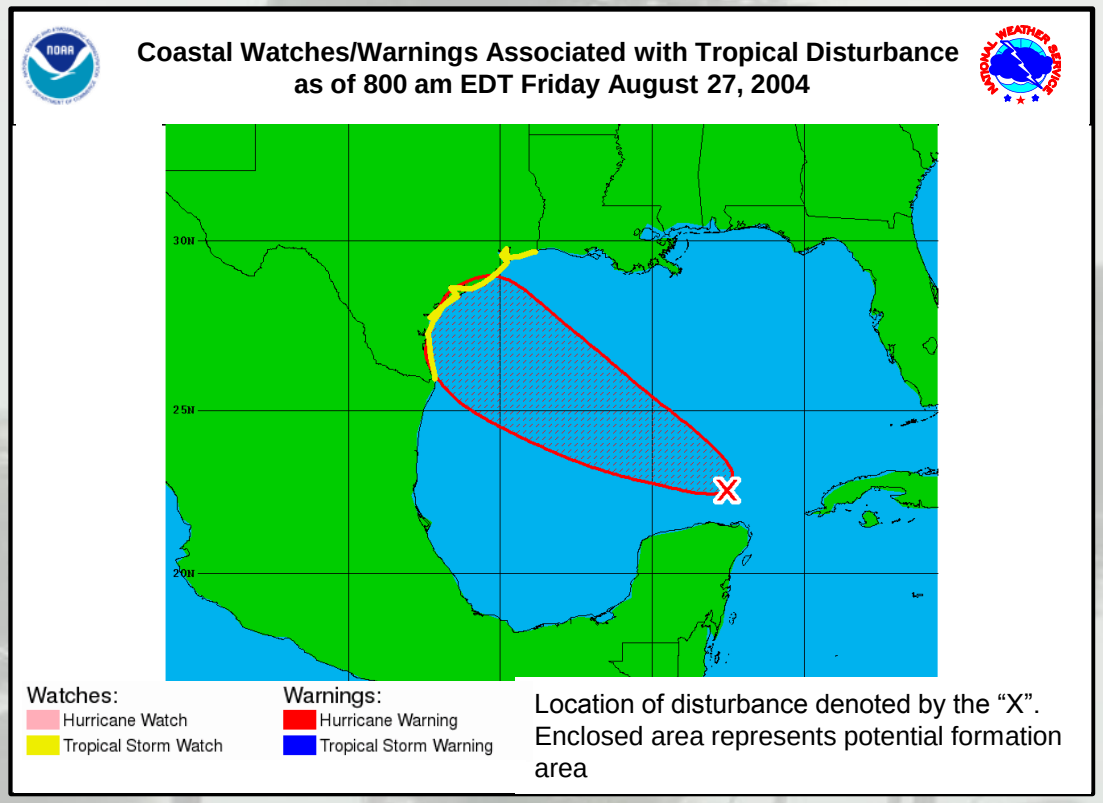
Sandy Track Guidance

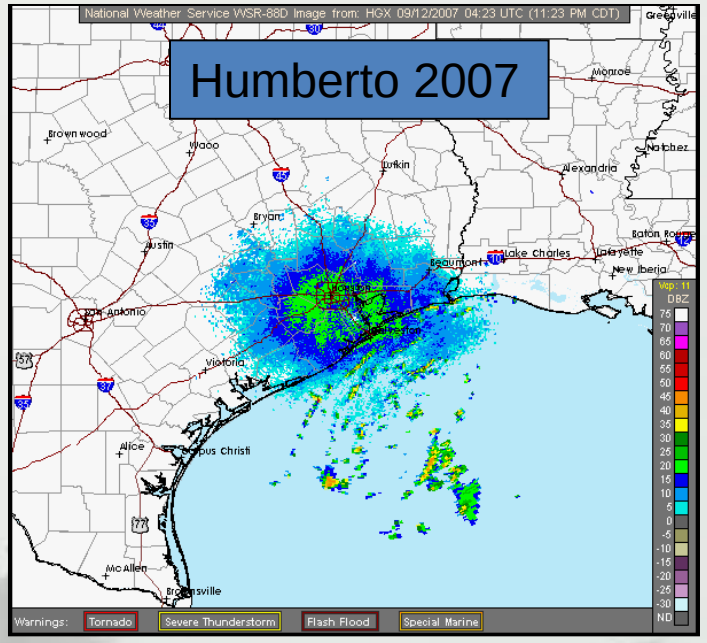
Models in excellent agreement



Tropical Storm & Hurricane Watches & Warnings Before Formation?

- Tropical cyclones occasionally form, strengthen, and affect land within the 36- to 48-hour watch/warning lead time





Tropical Storm & Hurricane Watches & Warnings Before Formation?

TROPICAL WEATHER OUTLOOK
NWS TPC/NATIONAL HURRICANE CENTER MIAMI FL
530 PM EDT FRI SEP 7 2007

FOR THE NORTH ATLANTIC...CARIBBEAN SEA AND THE GULF OF MEXICO...

SATELLITE IMAGERY INDICATES THAT SHOWER ACTIVITY ASSOCIATED WITH THE LOW PRESSURE AREA BETWEEN BERMUDA AND THE SOUTHEASTERN COAST OF THE UNITED STATES IS GRADUALLY BECOMING BETTER ORGANIZED. HOWEVER...AN AIR FORCE RESERVE HURRICANE HUNTER AIRCRAFT CURRENTLY INVESTIGATING THE SYSTEM HAS NOT YET FOUND A WELL-DEFINED CIRCULATION.
UPPER-LEVEL WINDS ARE BECOMING MORE FAVORABLE FOR DEVELOPMENT...AND A TROPICAL OR SUBTROPICAL CYCLONE COULD FORM AT ANY TIME AS THE SYSTEM MOVES WEST-NORTHWEST AT ABOUT 10 MPH. INTERESTS ALONG THE SOUTHEASTERN AND MID-ATLANTIC COAST OF THE U. S. SHOULD CLOSELY MONITOR THE PROGRESS OF THIS SYSTEM...AND TROPICAL STORM WATCHES COULD BE ISSUED THIS EVENING.

ELSEWHERE...TROPICAL CYCLONE FORMATION IS NOT EXPECTED DURING THE NEXT 48 HOURS.

$$

...TROPICAL STORM WATCHES COULD BE ISSUED THIS EVENING.

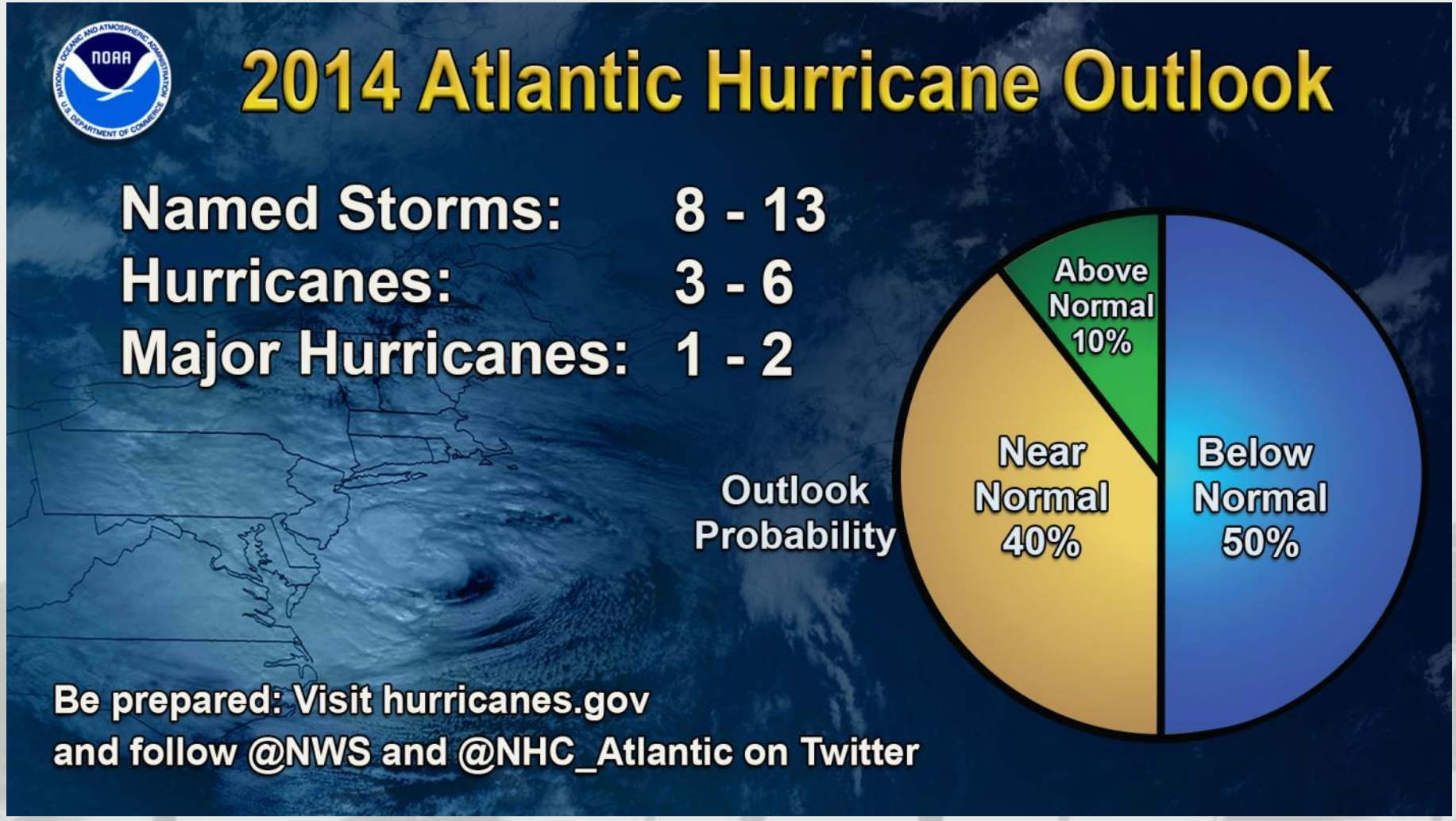
- Formation at any time
- Mentions the possibility of short-fused tropical storm watches or warnings

NWS Team Obtaining Customer Feedback and Developing a Path Forward

- Tropical Storm and Hurricane Watches & Warnings for tropical disturbances would increase public awareness and response.

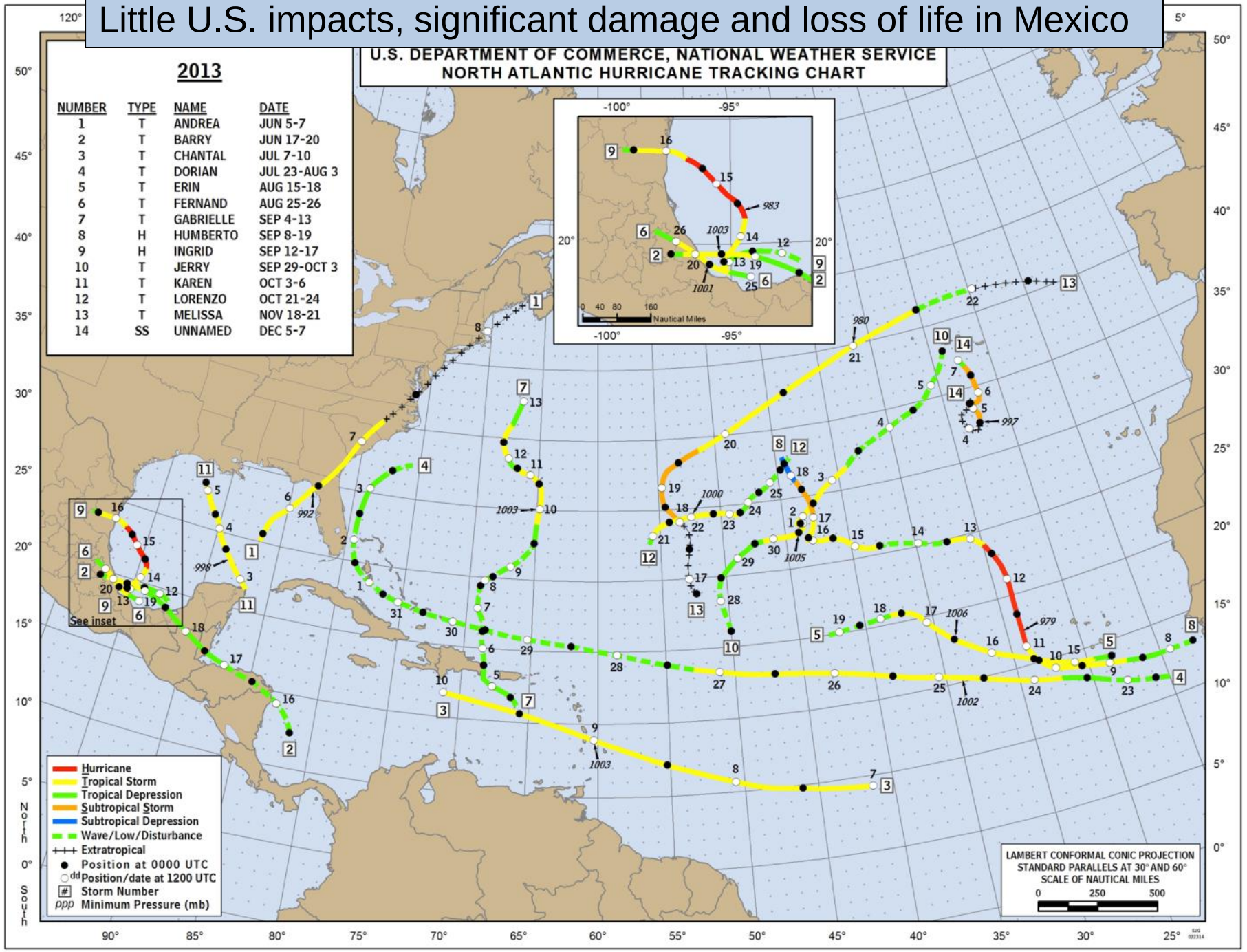
- NHC and NWS exploring ways these watches and warning could be issued and communicated (new graphics and products)

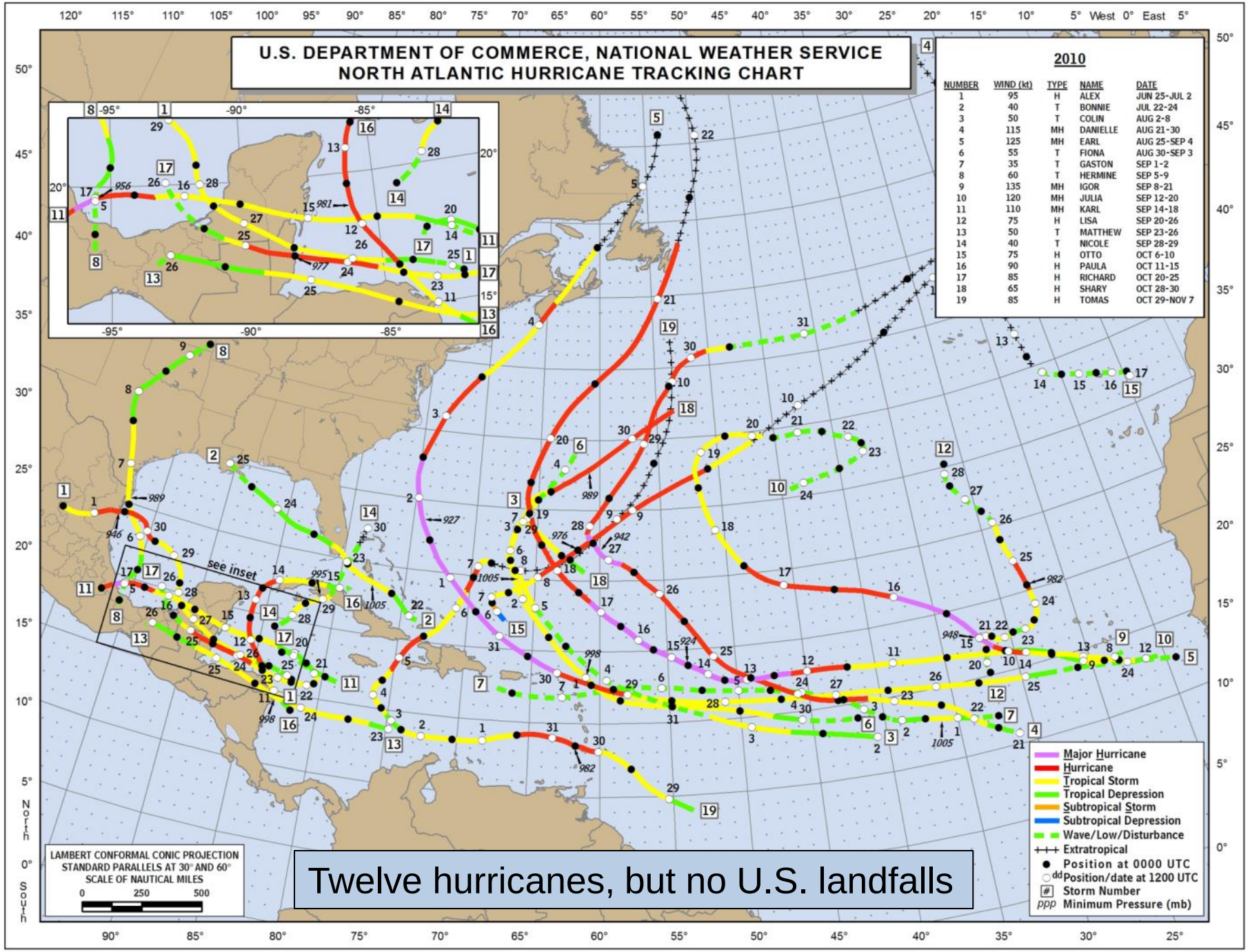
Seasonal Forecast Message
"It Only Takes One"

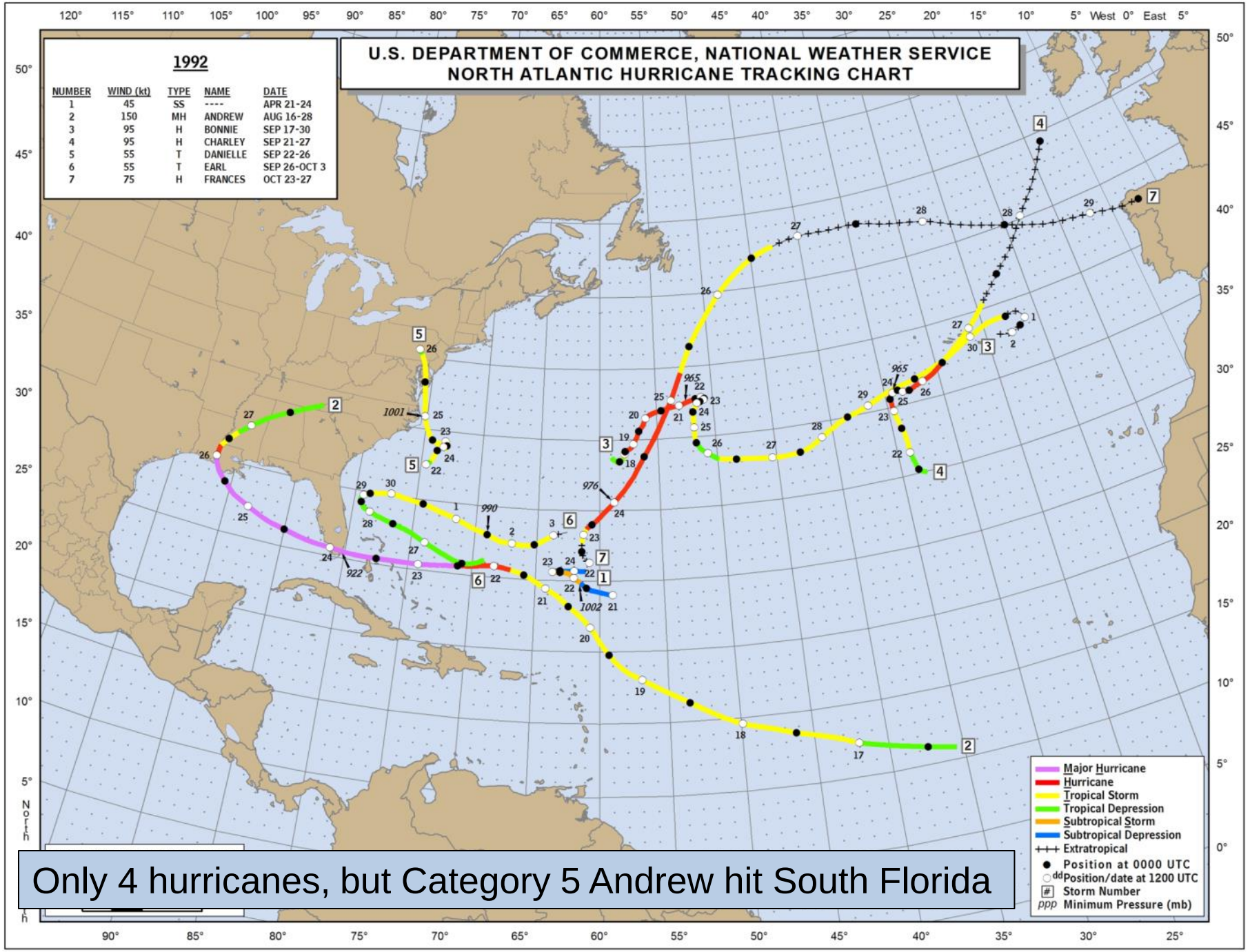


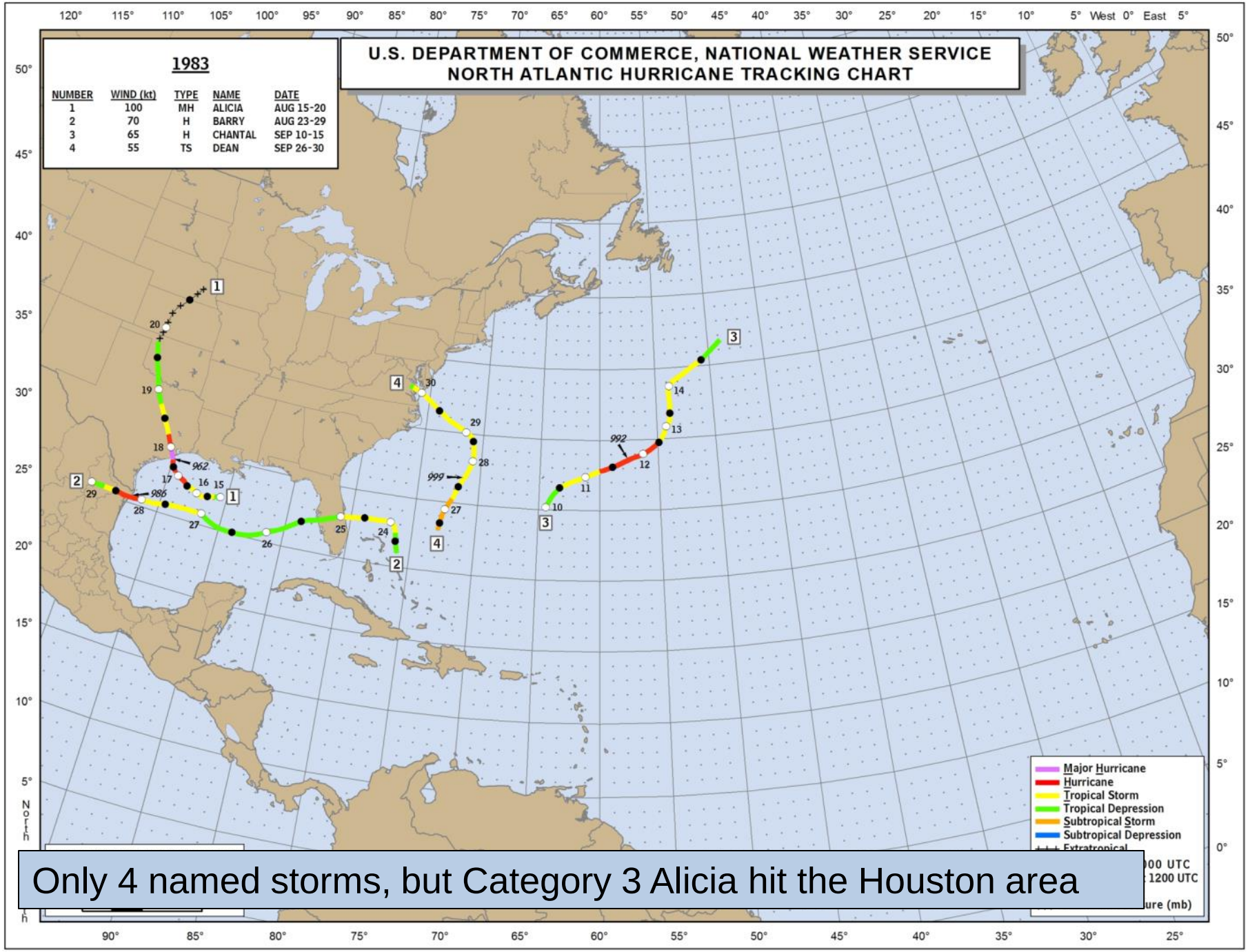
Says nothing about where storms will form or impact

Little U.S. impacts, significant damage and loss of life in Mexico

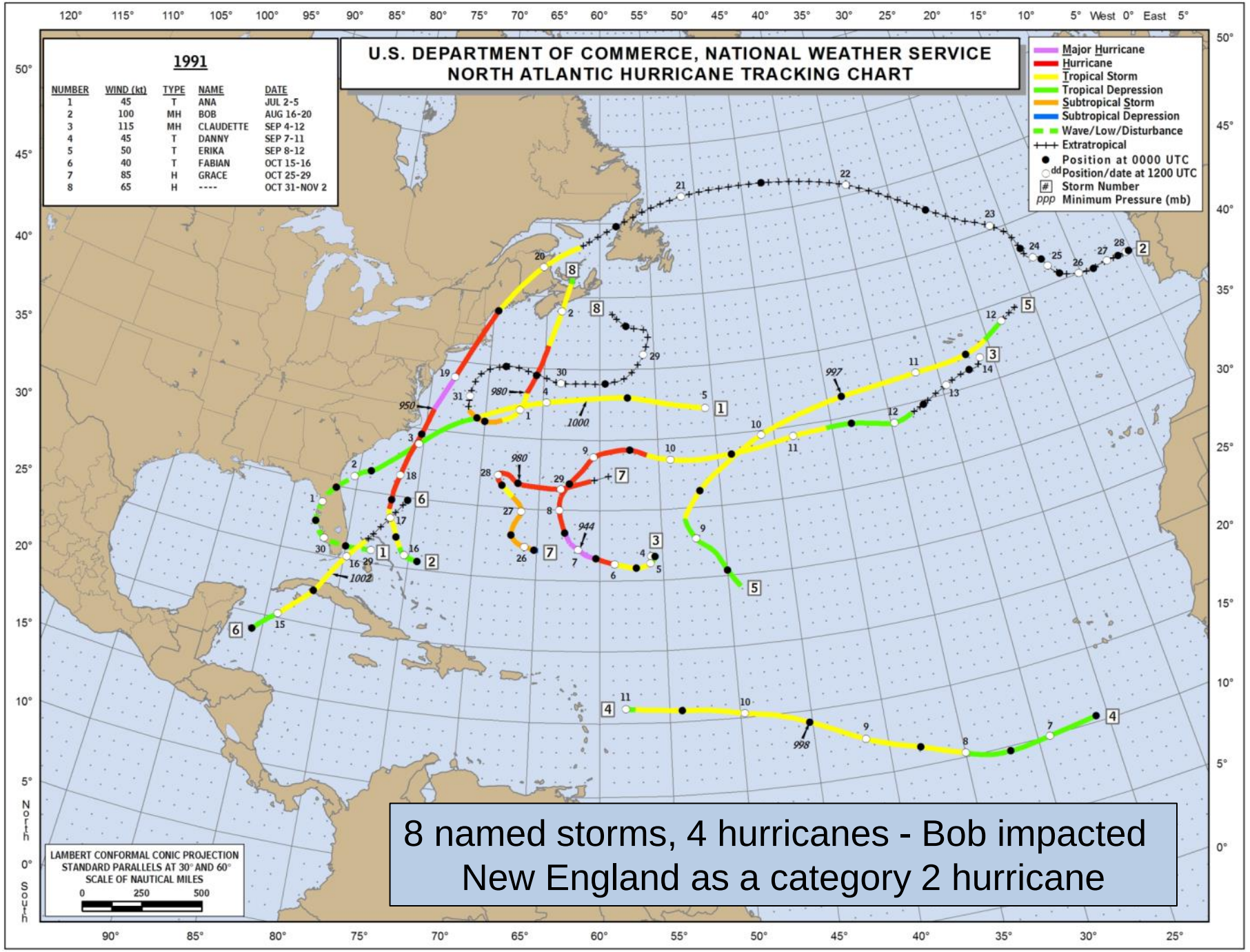



U.S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
2010
NUMBER WIND (kt) TYPE NAME DATE
1 95 H ALEX JUN 25-JUL 2
2 40 T BONNIE JUL 22-24
3 50 T COLIN AUG 2-8
4 115 MH DANIELLE AUG 21-30
5 125 MH EARL AUG 25-SEP 4
6 55 T FIONA AUG 30-SEP 3
7 35 T GASTON SEP 1-2
8 60 T HERMINE SEP 5-9
9 135 MH IGOR SEP 8-21
10 120 MH JULIA SEP 12-20
11 110 MH KARL SEP 14-18
12 75 H LISA SEP 20-26
13 50 T MATTHEW SEP 23-26
14 40 T NICOLE SEP 28-29
15 75 H OTTO OCT 6-10
16 90 H PAULA OCT 11-15
17 85 H RICHARD OCT 20-25
18 65 H SHARY OCT 28-30
19 85 H TOMAS OCT 29-NOV 7
see inset
Major Hurricane
Hurricane
Tropical Storm
Tropical Depression
Subtropical Storm
Subtropical Depression
Wave/Low/Disturbance
Extratropical
Position at 0000 UTC
dd Position/date at 1200 UTC
Storm Number
ppp Minimum Pressure (mb)
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 250 500
Twelve hurricanes, but no U.S. landfalls


1992
NUMBER WIND (kt) TYPE NAME DATE
1 45 SS ---- APR 21-24
2 150 MH ANDREW AUG 16-28
3 95 H BONNIE SEP 17-30
4 95 H CHARLEY SEP 21-27
5 55 T DANIELLE SEP 22-26
6 55 T EARL SEP 26-OCT 3
7 75 H FRANCES OCT 23-27
U.S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
Major Hurricane
Hurricane
Tropical Storm
Tropical Depression
Subtropical Storm
Subtropical Depression
Extratropical
Position at 0000 UTC
dd Position/date at 1200 UTC
Storm Number
ppp Minimum Pressure (mb)
Only 4 hurricanes, but Category 5 Andrew hit South Florida



Only 4 named storms, but Category 3 Alicia hit the Houston area


1991
NUMBER WIND (kt) TYPE NAME DATE
1 45 T ANA JUL 2-5
2 100 MH BOB AUG 16-20
3 115 MH CLAUDETTE SEP 4-12
4 45 T DANNY SEP 7-11
5 50 T ERIKA SEP 8-12
6 40 T FABIAN OCT 15-16
7 85 H GRACE OCT 25-29
8 65 H ---- OCT 31-NOV 2
U.S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
Major Hurricane
Hurricane
Tropical Storm
Tropical Depression
Subtropical Storm
Subtropical Depression
Wave/Low/Disturbance
Extratropical
Position at 0000 UTC
dd Position/date at 1200 UTC
Storm Number
ppp Minimum Pressure (mb)
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 250 500
8 named storms, 4 hurricanes - Bob impacted
New England as a category 2 hurricane

NHC Social Media

NHC Blog "Inside the Eye" expected to be introduced very soon.

The 2014 NHC Outreach and Education Season

World Meteorological Course for International Meteorologists

Two NWS Effective Hurricane Messaging Courses

FEMA (L-0320) Emergency Manager Course - New Jersey

Three FEMA (L-0324) Emergency Manager Courses

FEMA (L-0311) Courses at the National and Florida Governor's Hurricane Conferences

Other Key Outreach Activities

- Hurricane Awareness Tour- one week, alternating each year between U.S. Gulf (2014) and East Coasts (2015?)
- Caribbean Hurricane Awareness Tour
- National Hurricane Preparedness Week (late May)
- National Hurricane Conference
- State conferences

Thank You for Your Time

Questions and Comments:

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